Remineralize the Earth

Regenerating our soils, forests, and health
Replenishing soils with finely ground gravel and rock dust

Mr. Natural
Bob Cannard, Poster Boy for 90's Micro-farming and Remineralization

Fire in the Water
Dr. Olarsch on Trace Elements, Electrolytes and Life

Food Production Revolution
Missouri Aquafarmers Discover Huge Benefits in Trace Elements

DOUBLE ISSUE 12–13
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Remineralize the Earth

This magazine is a reflection, forum, roundtable of ideas, experiences and research of those concerned with networking and implementing soil remineralization. Articles, letters, and photos are welcome.

EDEN OR ICE AGE

Which Will We Choose?

The book *The Survival of Civilization* by John Hamaker and Don Weaver is regarded by a growing movement worldwide as a blueprint for the survival of the Earth, restoring ecological balance and, perhaps, even recreating Eden.

The remineralization of forests, farms, orchards and gardens with glacial gravel and rock dust is nature's way to regenerate and fertilize soils. During an Ice Age, as glaciers grind rock to a fine dust over millennia, a fertile soil is created. Adding finely ground gravel dust to soils is a tremendous boost to organic agriculture and can make it truly viable by adding up to a hundred elements and trace minerals needed by all life. Rock dust also nourishes the microorganisms in the soil, whose protoplasm is the basis of all living things.

There is evidence to suggest that as forests begin to die off worldwide, giving off carbon dioxide, the climate of the Earth is altered, triggering the transition from the warm interglacial to an Ice Age. We are hastening this process with the burning of fossil fuels. Undertaking the task of remineralization is urgent to restore our agricultural soils; to save the dying forests in the temperate latitudes; and to stabilize our climate.

Cover photograph: Bob Cannard on his Sonoma, California farm, by Joanna Campe.

PHOTO: LAURET SAVOY ➤

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PHOTO: HILARY ZALOOM

The enthusiastic *RE* staff and our Rock-Dust-toting gnome. From left to right: Robert C. Penn, Jr., Hampshire College; Emily Hatfield, Mt. Holyoke College; Joanna Devine, Lampson Brook Farm, Belchertown, Massachusetts.

LETTER FROM RE

Turning Point

This eagerly-awaited double-issue captures remineralization at a propitious moment in history. After over a quarter-century of focused activism, research, networking, and education, the remineralization movement has reached the minds and board rooms of mainstream agriculture. Results of the ongoing field trials at the USDA's Beltsville, Maryland, research center have been concluded and published. With upcoming interpretation and review by Ron Korcak and others, including staff writer David Yarrow, we can expect a re-focused effort by the aggregates' industry to commercialize by-product utilization.

Remineralize the Earth's foremost mission has long been to highlight the inspiring and ingenious work of small-scale farmers who are everyday bringing their little pockets of Eden into the world. They are here again: from Tim Carr's glorious fruit and nut farm in Huelo, Maui, remineralized with Azomite; to the newly-established Earth Regeneration Center of Cameron and Moira Thomson in the highlands of Ceanghline, Scotland; to the bioponics revolution in the heart of the Missouri Ozarks, piloted by Tom and Paula Spereano of the S and S Aqua Farm.

RE's foremost mission has long been to highlight the inspiring and ingenious work of small-scale farmers who are everyday bringing their little pockets of Eden into the world.

I envision the ***Remineralize the Earth*** organization — which is essentially a group of highly conscientious and dedicated individuals and co-operations — to critically

observe and guide the transference of remineralization to macro-scale agriculture. Just as the USDA's newly proposed organic standards have sparked heated debate, I hope the heritage of remineralization will continually inform the transition of agri-business to diversification and ultimately, sustainability.

The work of Western Australia's Men of The Trees in initiating country-wide awareness of the catastrophic effects de-mineralized soils have on forests provides a model for industry-organization partnership. As Boral Construction, Inc. has mounted a concerned field trial program in New South Wales, Men of The Trees' President, Barrie Oldfield provides guidance. Such partnerships abound, where the highly successful Champion Trees project has allied with the Planters II (method for cloned seedling propagation), as well as the Michigan Chapter's ground-breaking agreement with Schmidt's Nursery.

Underlying these broader, often politicized concerns of the remineralization movement is the fundamental knowledge that our de-mineralized soils proliferate physically identifiable keys to a larger sickness — under-nourishment and disease. David Yarrow's first installment of "Fire in the Water" ties the fine strands of essential physics and micro-biology to the rejuvenating properties of Dr. Gerald Olarsch's electrolyte complex, Trace-Lyte®.

As remineralizers are making connections with previously inconceivable opportunities and only recently appreciated scientific validity, the ***Remineralize the Earth*** organization has taken its own leap into transition. Since President Joanna Campe's sabbatical with her family in Kauai, Hawaii, I and two sage-like and yet quick-witted volunteers, Robert C. Penn, Jr. (Hampshire College) and Joanna Devine (Lampson Brook Farm apprentice) have maintained our subscribership and have written and edited the brilliant piece of work you now hold in trembling hands. I could not have floundered so gracefully without the immense contribution and support of David Yarrow, the kind guidance of Don Weaver, Barrie Oldfield, and most crucially, Joanna Campe.

—Emily Hatfield, Editor and Publisher

SOIL REMINERALIZATION *in context*

Soil Remineralization (SR) creates fertile soils by returning the minerals to the soil much the same way the Earth does: during an Ice Age, glaciers crush rock onto the Earth's soil mantle, winds blow the dust in the form of loess all over the globe. Volcanoes erupt spewing forth minerals from deep within the Earth, and minerals are contained in alluvial deposits.

Within silicate rocks are a broad spectrum of up to 100 minerals and trace elements necessary for the well being of all life and the creation of fertile soils. Glacial moraine or mixtures of single rock types applied to soils create a sustainable and superior alternative to the use of ultimately harmful chemical fertilizers, pesticides and herbicides.

SR has been shown in scientific studies to increase yields as much as two to four times for agriculture and forestry (wood volume), and to have immediate results and long term effects with a single application.

Hundreds of thousands of tons of appropriate rock dust for soil and forest regeneration are stockpiled by the gravel and stone industry.

A Brief History

Remineralization has mainly been researched and explored by three distinct groups:

First, German nutritional biochemist, Julius Hensel, pioneered SR in the 1880s with his book *Bread from Stones* and a modest agricultural movement came into being. Following his contribution, many scientists have done research on SR since the late 1930s in Germany and Central Europe for agriculture and forests.

More recent researchers include Peter von Fragstein at the University of Kessel, Germany, who has researched remineralization as a slow-release fertilizer with many different rock types and to deter insects.

The technology was not available at the turn of the century to produce finely ground rock dust, so SR, as promoted by Hensel, could not be produced feasibly on a large scale. SR was revived about thirty years ago in Europe. Many rock dust products for agriculture, forestry and sewage sludge treatment have been created in Germany, Austria and Switzerland in the last few decades and have been successfully marketed by the natural stone industry. Companies such as Lava-Union (Germany), Sanvita (Austria) and Zimmerli (Switzerland), along with many others and the Natural Stone Industry (Die Naturstein Industrie) based in Bonn, Germany have also done a great deal of research.

Second, is the more recently developed field of agrogeology. This re-search has been carried out mainly in Canada, Brazil, Tanzania, the Canary Islands, and West Africa — especially on laterite soils. Because of the intense tropical rainfall, NPK fertilizers are washed out in only a few weeks and cannot be stored by the soils, and are especially harmful to the groundwater. Rock fertilizers not only give nutrients over longer periods to cultivated plants, but also improve the ion-exchange-capacity of soils by forming new clay minerals during the weathering of the fertilizer. Researchers include William Fyfe and Ward Chesworth, among others.

Third, the grass roots movement concerned with the premise of John Hamaker in the book *The Survival of Civilization*, co-authored with Don Weaver, asserts that SR is not only the key to restoring soils and forests, but in the larger context, absolutely necessary and urgent to reduce levels of carbon dioxide in the atmosphere and stabilize the cli-

mate. Especially recommended are rock gravels and glacial moraine from glacial deposits which provide the most natural mixtures of rocks with the broadest possible spectrum of minerals and trace elements.

This movement began with John Hamaker's writing in the early 1970s and expanded in the 1980s into a global grassroots community consisting of ecologically concerned individuals and organizations, farmers and gardeners, scientists and policy makers.

To facilitate networking and the flow of information and promote SR as advocated by John Hamaker and Don Weaver, *Soil Remineralization, A Network Newsletter*, began in 1986 and became ***Remineralize the Earth*** magazine in 1991. The magazine has networked to people all over the world, collected research and a wealth of anecdotal results of farmers and gardeners to substantiate the results of SR. In October 1995, Remineralize the Earth, Towards a Sustainable Agriculture, Forestry and Climate, was incorporated as a non-profit organization.

On May 24, 1994, the U.S. Department of Agriculture (USDA) (Beltsville, MD), the U.S. Bureau of Mines (USBM) (Washington, DC), the National Stone Association (NSA) (Washington, DC), and the National Aggregates Association (NAA) (Silver Spring, MD) co-sponsored a forum on "Soil Remineralization and Sustainable Agriculture" at the USDA Agricultural Research Station in Beltsville, MD.

The Forum brought together the by-product rock fines generating industry and the proponents of SR to explore environmentally-sound uses of rock fines and to identify the state of the science supporting their use and the gaps in knowledge that need to be filled. The USDA began a series of demonstration trials with rock fines (from Georgia, Maryland and New York) and other industrial by-products. Dr. Ronald Korcak, research leader of the fruit lab, directed the trials over a three-year period. They are also researching the use of rock dust in compost under the direction of Dr. Larry Sikora. The now defunct U.S. Bureau of Mines designed a prototype for a GIS (Geographic Information Systems) database to target soils in most need of SR and their distance from regional sources of rock fines to calculate transport costs and marketability of specific rock fines. The National Aggregate Association has a Task Force on Remineralization exploring the possibilities for creating sustainable products for agriculture, forestry and other uses. Research projects are currently underway at universities and as part of research and development programs of some of the largest aggregate companies in the US, Europe and Australia and through organizations such as Men of the Trees in Australia.

Just a paradigm shift away from conventional chemical NPK farming is a vast new frontier, SR — key to the sustainable agriculture of tomorrow. The agenda for SR is clear. It will create abundance in an era of diminishing resources and shift us away from fossil fuels. Remineralization is nature's way to regenerate soils. We can return the Earth to earlier interglacial Eden-like conditions through appropriate technology.

—Joanna Campe

A Brief Perspective on

SOIL REMINERALIZATION AND THE CLIMATE

Soil Remineralization

The soils of the entire world have become severely demineralized by erosion over thousands of years. Plants require a continuous intake of minerals, just as we do, and for very similar reasons–calcium to build structural support, iron to carry oxygen, and so on. Plants growing on mineral-depleted soil do not get enough nourishment and so become smaller, less-abundant and less hardy, more vulnerable to the insects, worms and fungi that prey upon them.

Remineralization has been shown to cause a phenomenal growth of the microorganisms in the soil. It increases the nutrient intake of plants. It counters the effects of soil acidity, prevents soil erosion (for this reason alone, it would be worth applying rock dust), increases the storage capacity of the soil, contributes to the building of precious humus complexes, has anti-fungal properties, and when you spray it on plants it repels insects as well. The plants and trees become highly resistant to insects, disease, frosts, and drought.

Remineralization also enhances and speeds up the process of composting, so if you are composting for your garden, consider putting on some rock dust. Remineralizing by adding rock dust to compost is a very practical way to apply it to soils.

For Forests

◆ The results of long term experiments released in 1986 showed that in a forest where pine seedlings were remineralized, after 24 years the wood volume was four times higher than in the untreated area.

◆ Recent remineralization trials of a dying forest on Mt. Mitchell by Dr. Robert Bruck, Ph.D., showed that twelve weeks after application of rock dust, height growth of red spruce was increased by 27% over non-treated controls, and height growth of Fraser fir was 19% greater than the untreated controls. (*Forestry Research* packet)

◆ The Men of the Trees organization in Australia is doing remineralization trials with many species of trees in Australia with phenomenal results, such as five times the growth of tree seedlings of one variety of eucalyptus, over the untreated controls. (See *Forestry Research* packet)

For Agriculture

The best source of soil minerals is simple

crushed gravel dust. In 1976 John Hamaker spread gravel crusher screenings on part of his ten acres in Michigan. The following year, in an area of sparse rainfall and dry summers, and with no irrigation, his corn produced 65 bushels per acre, compared to yields of under 25 from other local farms.

Moreover, when independent analyses were done, Hamaker's corn was found to contain 28% more protein, 47% more calcium, 57% more phosphorous, 60% more magnesium and 90% more potassium than the same type of corn grown with chemical fertilizers nearby.

Twenty years ago the USDA published studies which showed that cement kiln dust (a less-satisfactory source of minerals) also produced better crops, but they couldn't understand "what element" in the dust was responsible and dropped the matter.

Hamaker estimates that on fully remineralized soil, American agriculture could grow four times as much food as it is capable of now — or the same amount of food at about one-fourth the cost — and with no pesticides or chemical fertilizers.

PHOTO: AL WERNER

Glacial moraine — debris left by glacier — in Spitzbergen, Norway.

The Nutritional Aspect

When we eat food grown on depleted soil we too, like the plants, lose our natural resistance to disease. All the degenerative diseases have been on the rise in America in recent decades. Dietary fat, cholesterol, salt and overly-refined foods seem to be major factors, but a serious deficiency of minerals in our food may be another. Mineral depletion of soils has been found to be directly correlated with death rates. And deficiencies of only one of a number of trace minerals — copper, iron, selenium, etc.— have been found in laboratory studies to be associated with an increased risk of cancer.

A Global Perspective On Climate

The problem of soil demineralization also has a global perspective. It is known that the Earth's soil becomes demineralized during each interglacial period, the relatively short 10,000-year warm period between each 90,000-year major Ice Age. Consequent decline in the world's forests and other vegetation causes a release of carbon dioxide into the atmosphere and reduces available sinks for the collection of carbon dioxide. The level of carbon dioxide in the Earth's atmosphere has been rising exponentially for the past century. Carbon dioxide and other greenhouse gases trap excess heat from the sun, potentially affecting the world's climate.

It is also well-known that when the glaciers advance and then recede during each recurrent Ice Age, they grind down rocks in their path, and this mineral-rich dust is blown far over the surface of the Earth, remineralizing soils and causing plant life to thrive again.

John Hamaker has supplied one missing piece to a cosmic puzzle, providing a long sought explanation, of the awesome 100,000-year cycle of major Ice Ages. Hamaker points out that the greenhouse effect occurs primarily in the tropics, which get the most sun, rather than in the polar regions which get very little. When the temperature differential between the tropics and the poles increases, there is a resultant cycle of fierce wind systems, hurricanes, tornadoes and storms.

The moisture absorbed by these increasing storm systems is transported to the higher latitudes, where it gets deposited as snow and ice, eventually inducing glaciation and the next Ice Age. Evidence points to this occurence in recent years, with record snow cover in the Northern Hemisphere and a shortening of the growing season, by *weeks* in some places, a pattern which is also accelerating year by year. Hamaker estimates that within a few decades the growing season may have decreased so much that millions of people will starve, in the richer nations as well as the poor.

Remineralization of the world's soils and forests will propagate carbon sinks, thereby absorbing carbon dioxide from the atmosphere–and overall, contributing to climatic stability. By assuming the task of remineralizing the Earth's soils, much as the glaciers do during an Ice Age, we can create fertile soils and abundance. We can re-create Eden.

The above information is condensed from the writings of John Hamaker, Don Weaver, Larry Ephron and Joanna Campe. RE

How Soils Form

reprinted from: *Rocks and Fossils*, by Arthur Busbey, et. al.

Soil is a mixture of weathered fragments of rocks and biological material. It mostly forms from the local bedrock and debris moved in from elsewhere, sometimes from quite distant areas. The value of soil depends on the nutrients it contains, and this includes both the breakdown products of plants, and elements contained in rocks that plants extract. Primary rocks, such as basalt and granite, bring a variety of nutritious elements up from the Earth's mantle. If sandstone contains little but quartz, it is of no value to most plants. Being a recycled rock, made from weathered grains of other rocks, the nutrients once present have been removed by chemical and mechanical means and by plants. When crops are grown in quartz-rich soils, they must usually be supported by the addition of fertilizer.

Glaciers bulldoze all past soils and mix them with newly ground till, the debris of glacial scraping. They then cover the scraped land with thick deposits of new till. This is, perhaps, the best of all soils, because plants have direct access to the nutrients in the finely milled rock "flour". Glaciers continuously deposit large quantities of till as they melt. Extending glaciers push up large mounds of

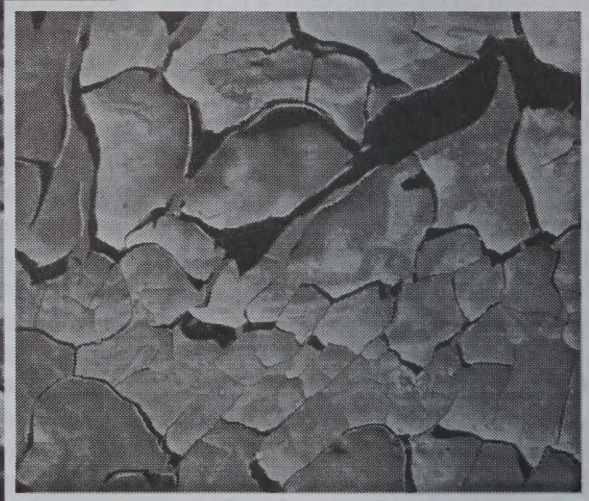


PHOTO: LAURET SAVOY

◄Debris-laden ice in glacier in Spitzbergen, Norway.

PHOTO: AL WERNER

till, while retreating glaciers dump hummocky sheets of it over the land. The till is then reworked by the strong winds that are a feature of glacial areas, and the more consistent winds of the open plains.

North vs. South

There is a fundamental difference between the soils of the northern and southern hemispheres, arising from their different geographic locations during the most recent ice age. Between 40,000 and 10,000 years ago, atmospheric cooling created major Arctic and Antarctic ice caps. The massive sheet glaciers that formed at the poles spread away from these centers, gouging and scratching the rocks beneath, grinding some to duct, and moving the debris across the land.

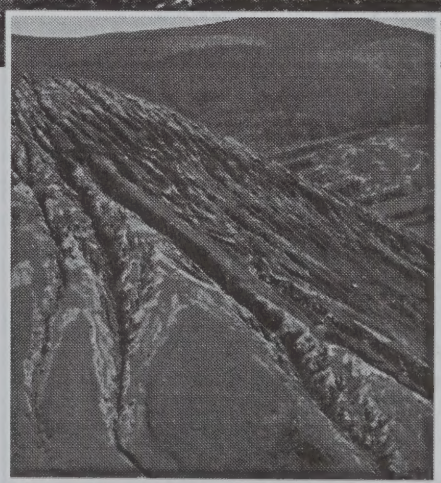
All the northern continents, connected as Laurasia around the North Pole, were covered in ice in the most recent glaciation. The glaciers moved south over Europe, Asia, and North America, spreading till as they melted and retreated. Antipodean glaciers ran into the ocean around the perimeter of Antarctica and no other southern continents were affected. The result is now reflected in the agricultural wealth northern hemisphere countries enjoy, all top-dressed with freshly milled rock flour. Southern hemisphere continents (Australia, Africa, and South America), largely unaffected by that glaciation, have to rely on older, poorer soils.

The real difference lies in the available nutrients. Northern-hemisphere soils consist of a deep layer of rock flour. Southern-hemisphere soils, often very shallow, have little crystalline rock mineral nutrient and each crop of plants waits on the death and decay of the previous generation. When crops are harvested from southern hemisphere soils, nutrients for subsequent plant generations are totally removed, and cannot be replaced from the local barren soils. For example, wheat crops from Australia and trees used for wood chips in the Amazon Basin of South America both grow in quartz-sand soils. Harvesting from these areas guarantees future deserts in both location. Although clear division is made here between northern and southern hemispheres, the real division lies between areas that have and have not undergone a recent glaciation.

In southern hemisphere countries, the soil that was present at the time of the assembly of Gondwana is still in use. Rain during 250 millions years has leached soluble minerals from this soil, leaving only the most insoluble residues: quartz, iron oxide, and aluminum oxide. These are the typical components of desert sands, and a long, slow succession of plants is needed to return such areas to forest.

Haystack Rocks

As one travels across the endless northern prairies and through New England, North America, large "haystacks" appear in the distance. These are solitary monolithic rocks. No other rocks may be visible in any direction. Close inspections shows that they sit on soil, but no amount of digging reveals any bedrock. They are glacier-transported haystack rocks, or erratics, the source of which may be 1,000 miles (1,600 km) closer to the North Pole than where they stand. Most haystack rocks bear no resemblance to local bedrock, but if you follow the direction of past glacial travel back toward its source, the origin can be found. They were carried and dumped amid the debris of glacial scraping by a melting glacier in the most recent glaciation. Prairie winds then totally exposed them. RE



PHOTOS: AL WERNER (ABOVE), LAURET SAVOY (INSET)

Above: Ice-covered Haleocene moraine associated with the Muldro glacier, Dinali National Park, Alaska.

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A Rock Dust Primer

What type of rock is best?

Feeding poor soil with mixed rock dust may be compared to feeding an ill person a varied diet of unrefined, natural food. If no one single food is a panacea, it might follow that no single rock type is "ideal." Indeed, the virtue of glacial gravel is said to lie in its broad spectrum of rock types. The late John Hamaker advocated the use of glacial gravel dust, ideally followed by river and seashore gravels and mixtures of single rock types. In the book *The Survival of Civilization*, John Hamaker suggests finely-ground glacial gravel because that is nature's way throughout millennia to create fertile soils. Glacial gravel, which is a natural mixture of rocks, will create a broad spectrum of minerals in the soil in a natural balance.

Much of value can also be gleaned from Europe and the research and experiences there where single rock types and combinations of single rock types such as basalt are used.

Hamaker asserts that "Micro- organisms select what they need to make the compounds of life, and reject to the subsoil what is not needed, [such as] aluminum, silicon, iron, etc., which are generally in excess [in gravel dust]." He further points to the "Kervran research on biological transmutations," which suggests that biological organisms may play an active role not only in selecting specific elements, but also in modulating their elemental nature to create needed materials where they are in short supply. Hamaker says, "As long as the soil is neutral [in pH] or close to it, microorganisms will control what goes into the plant roots. These controls are off when the soil is acid or acidic chemicals are added."

Composting with rock dust

Combining gravel dust with organic materials in compost is a great way to solve application problems and speed up the process. Don't forget a handful of soil to inoculate with organisms. Gravel dust improves aeration and structure and therefore prevents rotting. Gravel dust is assimilated even more quickly in compost than in poor soils.

Compost and gravel dust are a symbiotic combination: the compost provides an excellent medium for the "microorganism population explosion" promoted by the dust, and the gravel dust will not only help create more organic matter, but will also help hold it in place, reduce odors and conserve it.

Add 2-20 lb. of rock dust per cubic yard of compost, if one is doing pile or window composting.

Soil acidity

Soil pH should be measured annually. If the soil is acidic, agricultural limestone may be added together with the rock dust to bring the soil pH to neutral. Gravel dust will also neutralize soils to a great degree, but limestone is a quick remedy for agricultural soils. Limestone is not recommended for forests as it will destroy the humus-building complex in the long term.

Keep insects in natural balance in your garden

For short-term rescue, very fine dust sprayed directly on plants and trees has been shown in research in Germany to deter insect infestations very effectively. Trails of rock dust around the garden help keep slugs out. And healthy remineralized plants will not be plagued by insect infestations in the future as they become healthier and more insect resistant.

How to apply gravel dust

There are many ways to apply dust to the soil; which method you use depends on the scale and your preference. It can be spread by hand out of a wheelbarrow using a shovel, or roto-tilled and disked in. You can use

a wet agricultural lime spreader. If equipment is available that contains an agitator (to maintain particles in a suspended state), a wet spray can be used.

Organic farmer John Sundquist, Oregon, applies it with a manure spreader, bander, or an "E-Z Flow" type fertilizer applicator. He also uses rock dust in a potting soil made of compost, ashes and peat moss.

Approximate Application Rate Conversions

3 tons per acre =	14 lb. per 100 sq. ft.	= 1.25 lb. per sq. yd.
10 tons per acre =	46 lb. per 100 sq. ft.	= 4 lb. per sq. yd.
20 tons per acre =	92 lb. per sq. ft.	= 8 lb. per sq. yd.

How much to use

A grower of crops or a gardener needs a good response the first year after a fall application. The response in any one year depends on the amount of minerals available to the microorganisms, soil moisture and the amount of inert organic matter.

If the last two factors are satisfactory, as little as 3 tons of gravel dust per acre worked into the top 4 inches of soil should give good results. However, I prefer about 10 tons per acre worked in about 8 inches, since one application will eliminate the cost of a number of more frequent applications and give high yields.

The *Application Conversion Chart* above will help you to determine how much gravel dust to use: 3 tons/acre is considered the minimum application, 10 tons/acre is Hamaker's preferred long-term application, and 20 tons/acre is given as a major remedial application for especially dry, poor soil. Smaller amounts are recommended if the rock dust is finer than -200 mesh and larger amounts if much less fine than -200 mesh.

Finding local sources of gravel dust

To find gravel-grinding operations in your area, call your local gravel pit (look in the *Yellow Pages* under "Cement-Wholesale", or "Sand and Gravel"), and ask if they have crushed gravel screenings made from mixed rocks, the kind that comes out of river beds — crushed and passed through a 1/4 inch or finer screen. The gravel dust will probably cost from $1-$8.00 per ton plus the cost of transportation if the gravel pit delivers it to your garden. As most of the cost is in transporting the rock dust, having a truck or access to one is an advantage. A cooperative initiative with friends and neighbors would also cut costs down.

The *Particle Conversion Chart* shows various categories of "soil separates" (ground particles) listed with their diameters in microns (thousandths of a mm.) and their corresponding screen mesh sizes. "Mesh" simply refers to a screen with a given number of holes per inch.

The more finely ground the rock, the more readily microorganisms will have access to the minerals. John Hamaker uses the term "gravel dust" to mean a dust "90% of which will pass through a 200-mesh screen."

You can also contact your local state Aggregate Producers Association, your local county DPW (Department of Public Works), your state DOT (Department of Transportation) Materials Bureau and you can contact the National Aggregate Producers Association (Tel: 301- 587-1400).

PARTICLE SIZE CONVERSION	PARTICLE DIAMETER(MICRONS)	MESH
Fine sand	250 – 100	50 – 125
Very fine sand	100 – 50	125 – 250
Silt	50 – 2	250 – 6000
Clay	2 or less	6000 or more

What does industry call the product?

It is referred to as pond settlings, rock dust, rock flour, classifier tailings, and minus #200 mesh. You should ask for minus #200 Mesh (–75 micron) material, pond settling, material that has gone over the weirs of a sand screw or the weir of a sand classification tank, or material obtained from the dust collection system. You should not use concrete sand, abrasive sand, filter sand, mason sand, blow sand (loess) screenings, as they are too coarse.

What is the best material to use?

Glacial sand and gravel that contain a myriad or heterogeneous combination of various rock formation type or mineralogy is preferred.

Other metamorphic or igneous stone such as basalt, rhyolites, etc., are highly recommended. Most sedimentary rocks (limestone and dolomite) are used to balance pH and provide for calcium and magnesium deficiencies.

Testing your gravel dust

Several people have reported that gravel dust does not work or it will have [only] a temporary effect. They don't describe the dust in detail, but there may be very little dust in what they call 'dust.' Know what you are buying or you may be badly disappointed.

Here are three simple, quick tests you can perform at home:

Pot Test: A pot test will give you immediate, practical proof of what the product will do in the soil. It is a good idea to add the gravel dust to clay pots and plant radishes or

other fast growing plants and observe their progress. As John Hamaker writes: "Doing a pot test is the most convincing argument I know of. Anybody can do it. There are testing laboratory grinders everywhere. There is no lag time. In 6 hours you can get a microorganism population explosion. Taking some 6" clay pots, I filled them with a fifty-fifty mixture of earth and peat and three heaped tablespoons of dust. The results were astonishing!"

You can compare different mixtures or samples of gravel dust depending on what's available in your area. Use a control without rock dust to compare as well. You can also begin with small plots in the garden. You can see the results of the gravel dust you've chosen and then add it in larger quantities to your garden. Work the gravel dust into the topsoil, if possible.

Separate Layer Test: Purchasing a product based on its stated screen mesh alone still leaves room for error. A purchase of 90%, or even 100%, of minus #200 mesh screenings could contain only sand and silt, and no true dust. This test will tell you approximately how much of your "dust" is really dust and will be suspended in water.

Fill a clear glass half full with your sample and cover it with about two inches of water. Shake it up vigorously, then allow it to settle overnight. The dust, silt and sand will settle into three distinct layers with the dust at the top.

If the container is allowed to stand until the water has dried out, the dust [topmost] layer will shrink to about 1/3 the original measurement and give a more accurate percentage of the dust. Your first observation, however, will tell you if you are buying mostly sand. The coarser the grind, the less effective it will be in the soil, and the more you will need to use per acre.

Moisture Test: If the material is bought by the yard, there is a probable increase in bulk when wet. The buyer needs to test so one can know the actual weight of dust one is applying to the land. Take a sample, weigh it, then dry it thoroughly in the oven [and re-weigh it]. This will tell you how much of the weight you are buying is moisture.

Ground glacial mineral fines slip easily through grower's fingers.

Chemical analysis

In some, but not all situations, having a formal chemical analysis may not be necessary. A pot test and small-scale trials with fast-growing plants will give you more accurate information and with less expense. In cases where you have doubt about its source, you may wish to have a gravel dust analyzed to ensure that it is free of radioactive elements and toxic industrial by-products. In most cases your source will have already had to undergo such testing in order to get a license to operate. This is worth some homework. If you are not able to obtain documentation to your satisfaction, it might be wise to go ahead and obtain your own independent lab tests. Good testing labs are listed in *Sources and Resources*.

More tips from Hamaker

"One other thing might be useful. I put about 2 inches of sand on our garden before plowing. It will last a long time and give some yield after the dust is used up. I am sure it has been contributing to what we grow. Unscreened sand (preferably fine sand) from a local gravel pit is much more economical than shipping dust which is mostly silt and fine sand.

Sometimes the gravel pits have mesh screens and can measure the exact fineness of the gravel. Though it may be hard to find the ideal fineness –90% passing through a minus #200 mesh screen–it may be practical to use even if only 20% or so passes through a minus #200 mesh screen and at least 50% passes through a minus #100 mesh screen. You will have the finer material immediately available to the soil and the rest will break down over time. If most of it passes through a minus #200-mesh screen, it will have a fine consistency like flour or cement. The gravel pit may have machinery to crush the rock finer and may crush it for you."

Soil erosion is an effect of the shortage of minerals available to support the soil organisms. As Hamaker says, "That shortage can be made up on any piece of land in the time it takes to work ground gravel dust into the topsoil. When that is done, the soil microorganisms begin to multiply and it is they who prevent soil erosion by granulating the soil and holding it against both wind and rain." For a more thorough understanding of SR, read *The Survival of Civilization* and order the Research Packets found in the *Sources and Resources* section of this magazine. RE

GaeaWatch

ABOUT THIS SECTION

- Climate change and weather and other earth processes and policies affecting Earth's atmosphere
- Role of minerals in soil, forests, and oceans to remove carbon dioxide and nourish all biomass
- Views, politics, cultural and spiritual perspectives
- Philosophies and strategies on global/local scales.
- General news

Evidence from animal extinctions, fossil remains and deep core drillings of polar glacial ice all indicate that the last Ice Age began within a climate change transition of 20-50 years. Where are we now?

Alarm amongst organic farmers across the nation. Grower Michelle Wiggins weighs onions for the CSA at Lampson Brook Farm, Belchertown, Massachusetts.

PHOTO: SARA WEIL

USDA releases standards for organic food production

Proposal sparks outrage and debate

BY JOANNA DEVINE

On December 15, 1997, the U.S. Department of Agriculture's National Organic Standards Board released its proposed federal standards for organic food. The USDA's National Organic Program, as mandated by the Organic Foods Production Act of 1990, "aimed to assure consumers a consistent standard for organically produced food and to facilitate interstate commerce in organic products." However, the impact of this program — specifically the new, federal labeling standards — has sparked outrage and debate among organic farmers, food activists, and organic consumers.

Many organic farmers see their success as a triumph against the modern trends in food production, as dictated by the USDA. And rightly so; a recent Eco-Watch from Acres USA stated that "the USDA devotes less than one tenth of one percent of its research budget to organic farming systems," according to a study by the Organic Farming Research

Foundation. The sudden intervention of the USDA will force organic farmers to pay hundreds of dollars for certification while conventional growers bear no equivalent costs to farm with chemicals. The proposed, universal flat fee for certification and registration will penalize small-scale growers. Many farmers fear the menace of the USDA guidelines on the self-determined organics movement. More specifically, farmers are angry at the injustice of USDA certification fees. The proposed standards are seen as a "watering down" of the term organic, favoring corporate food production and shifting the focus of the organic movement away from local production and local consumption.

On the other hand, the Organic Trade Association and other organic producers favor the establishment of national standards as a means to eliminate fraud in the marketing of organics. The guidelines released on Dec. 15, nevertheless, threaten to poison that vision. These standards extend eligibility for the organic label to irradiated food and genetically engineered products. Such inclusions pose potential threats not only to human health, but also to the health of a sustainable agriculture that promotes the balance of all living organisms as championed by the organics movement.

Resources

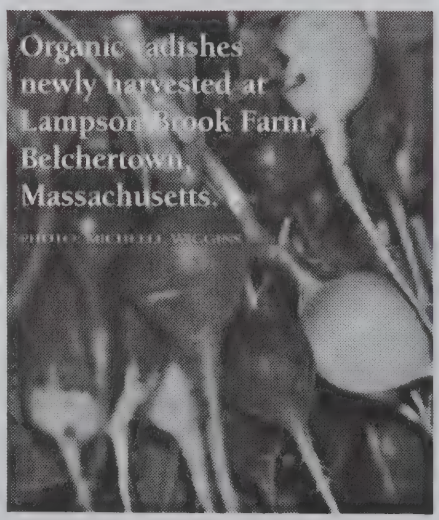
The proposed federal guidelines can be obtained on the Web at www.ams.usda.gov/nop, or ordered by mail from the Organic Trade Association (413) 774-5484.

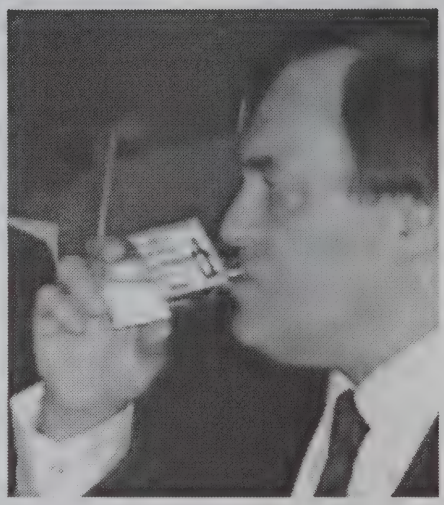
The National Organic Program (a division of the Department of Agriculture's Agricultural Marketing Service) advocates process-oriented standards for the health of the soil and the integrity of ecology-based growing systems. Their September proposal to the USDA did not include, for example, the certification of bio-engineered food. The original NOP rules went to the Office of Management and Budget and emerged in the drastically weakened form that the USDA released on the 15th of December. Many cite this weakening as another example of the dramatic influence of agribusiness and the large chemical companies that fund genetic engineering research.

The rules are now open for public comment. The NOP staff will utilize this public comment period to reintroduce the original language of the program and its standards. Meanwhile activists from environmental and agriculture groups have mobilized support across the country urging the USDA to rewrite or withdraw the proposed rules.

The swell of public outcry has prompted Agriculture Secretary, Dan Glickman, to extend the public comment from its March deadline to April 30. "We have already received over 4,000 comments on the proposed rule, including many requests for an extension of the comment period. Given the complexity and importance of the organic standard proposal, we are extending the comment period to provide an opportunity for even greater public participation," Glickman said in his announcement to extend the comment period.

Your comments on the USDA organic standards can also be submitted at the USDA AMS National Organic Program Proposed Rule web site (www.ams.usda.gov/nop) or sent in writing to Eileen Stommes, Deputy Administrator, USDA, AMS, TM, NOP, Room 4007–S, AgStop 00275, P.O. Box 96456, Washington, D.C. 2009 — 456 or by fax (one copy) to (202) 690-4632. RE





John Prescott, deputy prime minister (UK), samples meltwater from the Antarctic ice caps which environmental activists were distributing to delegates arriving for the high-level segment.

Kyoto conference yields world accord

By Joanna Devine

After eleven days of negotiations, the Kyoto Conference on climate change ended in a landmark accord. The treaty was approved by representatives from over 160 countries. December's accord requires an average 5.2 percent reduction in greenhouse gases from recorded 1990 levels during the four years from 2008 to 2012.

The industrialized nations agreed to cut emissions from between 6 percent to 8 percent below 1990 levels — the European Union will reduce its emissions of greenhouse gases by 8 percent; the U.S. by 7 percent; and Japan agreed to a 6 percent reduction. Similar targets were adopted by twen-

ty-one other industrialized countries. U.S. representative, Stuart Eizenstat, was disappointed by the lack of "significant" targets for emissions reduction for developing nations. This is bound to be one of the issues addressed at a follow-up meeting planned in Buenos Aires for November.

Another crucial facet of the accord — the trading of emissions credits — will be developed at the Buenos Aires meeting. The treaty allows emissions "credits" to be traded as a commodity. Countries that reduce their emissions beyond set levels will thus be able to sell permits to countries that need them to meet their quotas. This system, it's argued, will weaken sincere efforts at emission reductions in the industrialized nations like the U.S.; the country could avoid emissions controls by investing in reduction efforts overseas.

Those who criticize the trading system say that it shifts nations' focus away from developing sound, low-emission technologies to meeting quotas by relying on reductions elsewhere. The treaty includes the creation and funding of a new international agency to facilitate emissions trading between nations — the Clean Development Fund.

Many environmentalist and conference negotiators feel that, regardless of the trading systems, reduction targets are too weak to prevent the climate crises threatened by a warming. The treaty's goals will merely slow the rate of warming and many believe these levels inadequate to deliberate the impact of climate change on human systems. Island nations were especially disappointed with the accord, as the increase in violent storms and rising sea levels promise impending disaster.

The accord, nevertheless, marks the first extensive international environmental treaty on one of the most politically charged international environmental issues. As a "first step", the Kyoto conference was successful in challenging nations to turn emission reduction targets into reality. The conference has also provided crucial momentum in assessing the impact of anthropogenic greenhouse gases — a springboard to analyzing the effects of our energy use, land use, industry and agriculture. RE

Advancing the Hamaker Thesis

Global Warming leads to a second Ice Age

By Don Weaver

If you're new to the long-standing debate on our changing climate, the above title may sound like it blared from the front page of a supermarket tabloid, and maybe it has. Not surprisingly, it has been seen headlining the *New York Times, the San Francisco Chronicle,* and magazines such as *Time* and *Newsweek.* It appears a growing number of scientists, in concert with the media, may be close to confirming this highly probable — if not certain — future.

Having collaborated with the late John Hamaker (1914-1994) — a unique ecological genius dedicated to "The Survival of Civilization" (also the name of our 1982 book) — I've tried to advance the Hamaker Thesis. Explaining the glacial-interglacial climate cycles (25 discovered over 2.5 million years), it has the potential to inform action and regulatory measures put forward by governments world-wide. In circulation are 14,000 copies of the book plus many thousands of *Solar Age or Ice Age?* bulletin updates, ***Remineralize the Earth*** magazines, and Larry Ephron's book and video on "Stopping the coming Ice Age".

A great number of scientists, political representatives, journalists and "ordinary citizens" are becoming concerned with our eco-climatic present and future

What is clear is that currently a great number of scientists, political representatives, journalists and "ordinary citizens" are becoming increasingly concerned with our eco-climatic present and future, while growing more attentive to the answers provided through understanding our climatic past.

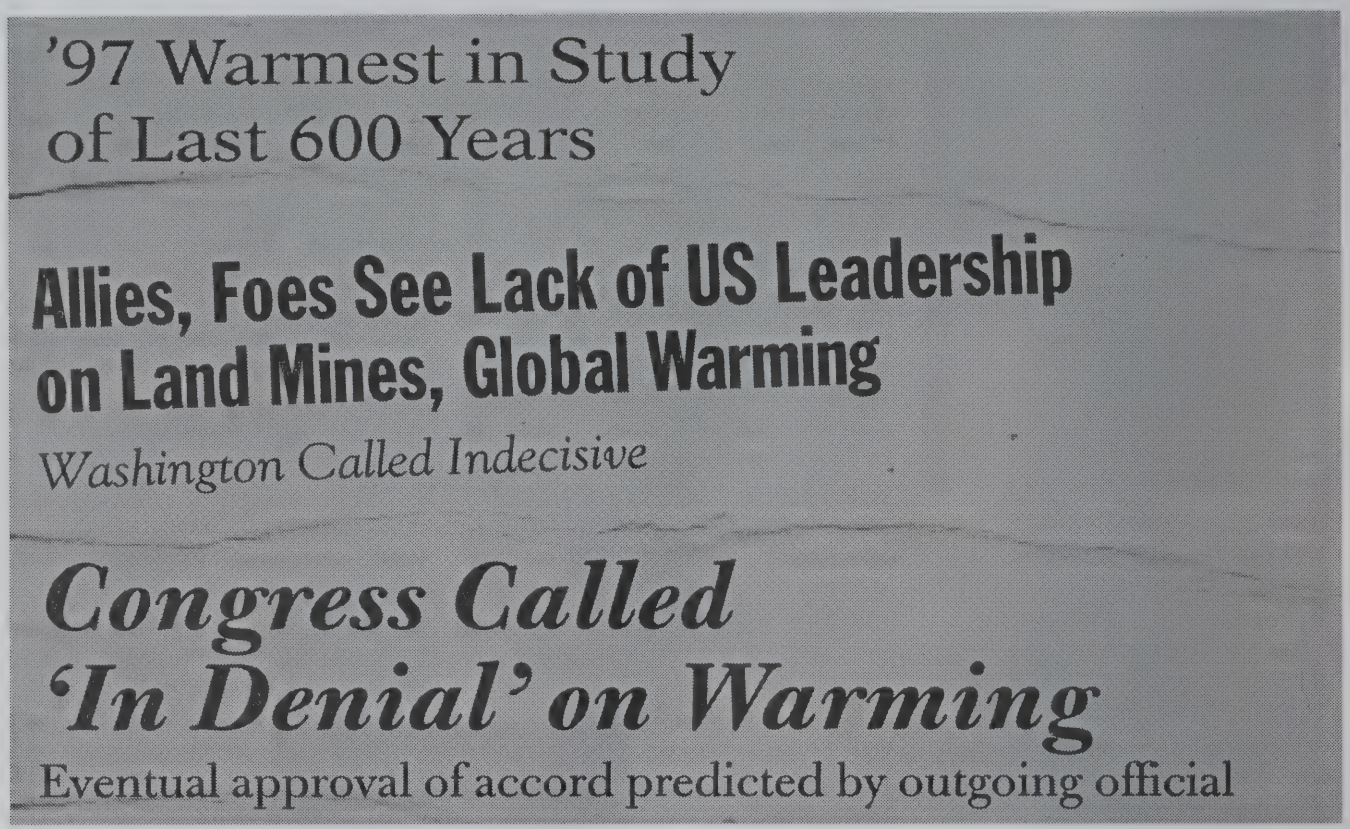
A recent *San Francisco Chronicle* article (10/1/97) entitled, "1,500 Top Scientists Plead For Global Warming Curbs", begins with the international meeting in Kyoto, Japan, scheduled for December, 1997, to "address one of the most serious threats to the planet and to future generations." The agenda continues: "Nearly 1,500 of the world's top scientists, including a substantial majority of the living Nobel Laureates in science, issued an urgent call yesterday for the nations of the world to take strong, binding steps toward curbing global warming."

President Bill Clinton claims to support such actions, in order "to avert a potential catastrophe" and says we now know enough about global climate change "to warrant responsible action" (*San Francisco Chronicle,* 10/7/97).

Scientists have learned much from past glacial periods (see *Ascent of Mind*, William H. Calvin). Yet how much of this learning is simply "information" and how much could be called "wisdom"? How much of it inspires and empowers our capacity to act, as Clinton suggests, responsibly?

Some of the more obvious and primary actions we can each employ immediately include: soil remineralization with rock dust; planting trees, orchards and gardens; composting; using non-toxic and recyclable products, using solar energy for transport and power; and emphasizing superior mineralized and organic fresh foods for optimal health of the land and its inhabitants.

Environmentally responsible individuals,


'97 Warmest in Study
of Last 600 Years
Allies, Foes See Lack of US Leadership
on Land Mines, Global Warming
Washington Called Indecisive
Congress Called
'In Denial' on Warming
Eventual approval of accord predicted by outgoing official

choosing regenerative ways of living, can in fact transform the orientation of business and manufacturing to meet the needs of the human race and the entire Earth. Of course, a government and industry commitment to environmental health is essential to provide us with our best chance of reversing processes of decline and imbalance which have been many years in development.

The following sources have recently shown support for the Hamaker Thesis:

From *Global Change Newsletter* (March 1996, p. 8): "Thus the global climate system seems to be more stable when the Earth has a huge volume of water locked in ice sheets in polar regions than under the present condition with ice sheets existing only on Antarctica and Greenland. It is therefore possible that the present global warming may act as the trigger of the next glaciation. If the interglacial is indeed a brief, unstable period for the Earth, then we should be very careful not to risk triggering the shift to the next glacial period through anthropogenic activities." (Isamu Kayane, "Interactions Between the Biospheric Aspects of the Hydrological Cycle and Land Use/Cover Change")

In "Icy Clues to Climate of the Future" (*Los Angeles Times*, Sept. 8, 1997): "Ice cores reveal hints that the effect of any global warming might, paradoxically, trigger cold weather severe enough to cause a global winter lasting years. The shift from the warm contemporary climate to an ice age could take less than a human lifetime.

" 'It raises the possibility that, by putting out greenhouse gases, humans may make the climate unstable and plunge us in as little as a decade into severe cold periods,' said Kendrick Taylor at the Nevada Desert Research Institute, chief scientist for a consortium of fifteen universities using ancient ice cores to investigate climate.

"Analysis of the ice suggests that the Eemian (last interglacial period) may have ended with a gradual global warming that triggered two dramatic decades-long pulses of chill temperatures, which in turn culminated in thousands of years of glacial cold.

"The effect is more logical than it sounds. As the climate warms initially, scientists explain, there is more moisture in the air; therefore, more snow falls each winter. More snow builds up as glacial ice, which in turn reflects more of the sun's heat, lowering global temperatures dramatically. If the glaciers spread over enough of the earth, the cycle can quickly refrigerate the planet."

John Hamaker explained how the increased tectonic activity, occurring with snow and ice buildup, can also heat up the tropical oceans though sea floor vulcanism and, along with the greenhouse effect, can be a prime cause of the El Niño phenomenon. The destructive weather of this year and years to come cannot, however, be blamed solely on El Niño. With a threatening Ice Age approaching, we must regard the total transformation of global warming as a very real problem — and a raised environmental conscientiousness within our society as our only solution. RE

Are world health organization standards an attempt to kill herb therapy?

Codex regulatory commission prompts concerns

The World Health Organization and the United Nations have recently developed a regulatory commission. It's called Codex, which is short for the latin *Codex Alimentarius,* translated — "nutrition code." Codex's perogative is to set world-wide standards for a variety of foods, drugs, and pesticides. The regulation of the distribution and trade of a variety of vitamins, minerals, and herbs has sweeping ramifications: many believe that the Codex movement is an attempt to abolish herbal therapies all together.

The Codex commision meets every two years, and any countries' delegate may propose a change in its standards. Most recently, the German delegation presented a bill stipulating the following:

- No vitamin, mineral, herb, etc. can be sold for prophylactic (preventitive) or therapeutic use.
- None sold as a food can exceed potency (dosage) levels set by the commision.
- Codex regulations for dietary supplements are binding — a nation is not allowed to set its own standards.
- All new dietary supplements become automatically banned untill they go through the Codex approval process.

The US delegate, Elizabeth A. Yetley, PhD, RD — a Food and Drug Administration beurocrat—has voted against the plan in the past, but with little result. This year's meeting produced a 16-2 vote in favor of Germany's bill.

It would be difficult to measure to what extent larger drug companies are involved in these proceedings, and consequently, the sway of votes. Glancing at the guest-list for the conference, it becomes clear that there are vested interests at work — over 90 percent of the delegates present represent large international pharmacutical companies.

Though this alone should present a red flag to the international community, there has been little response to recent developments, mostly because the Codex task-force meets quietly in Europe and very little has been publicized on the issue. In his recent article

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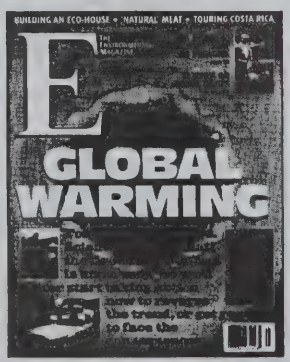

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on Codex as published in Second Opinion, Dr. William Campbell Douglass comments: "This semi-secrecy is typical of the world government's beuracrats when they want to pass regulations with a minimum of fuss from the people being regulated."

In light of the changes going on, it is not suprising that many pharmacutical companies are working to create pharmeutical versions of many traditional produced and commonly traded herbs — herbs which may become illegal to carry or distribute within a few years. Among the products which may become unavailible are DHEA, melatonin, fish-oil, cranberry capsules, hawthorne-berry capsules, amino acids, chromium picoliate, saw palmetto, ginger, and St. John's wort.

The FDA's modus operandi has been officially reported: "ensuring that the existence of dietary supplements on the market do not act as a disincentive for drug development." (FDA Dietary Supplement Task Force Report, May 1993) Implicitly, the FDA's policy is to encourage mainstream pharmeceutical's industry development and to discourage the use of dietary supplements.

Even if natural products do not become illegal, it is likely that they will become unaffordable. The proposed drug identification numbers — Codex's seal of approval — would each cost approximately $15,000. The economic pressure would leave many natural product manufactuers, and their health-food store distributers, out in the cold.

If you'd like to take action and voice your concerns, contact:
Dr. Robert Moore FDA Office of Special Nutritionals (HFS-456), 200 "C" St. S.W., Washington, D.C. 20204

For more information and to find out how you can get involved, write to:

International Advocates for Health Freedom, Attn: John Hammel, 2411 Monroe St #2, Hollywood, FL 33020, USA, phone: 1-800-333-2553, fax 914-927-8795, e-mail jham@concentric.net. You can also visit his web site at: http://www.pnc.com.au/~cafmr/hammell/index.html. RE

LYNDSEY A. INGRAM

Main Street in Twin Hills, Alaska.

Rise in permafrost temperature may point to global warming

Electronic Telegraph, Oct. 9, 1997

Frozen soil that underpins much of Alaska is melting, revealing that the United States may be suffering one of the first tangible consequences of global warming. Scientists have discovered that temperatures in Alaska are rising three times faster than in the rest of the Arctic. Three feet below the surface, the permafrost soil, which is supposed never to thaw, is one degree warmer than it was a decade ago.

Professor John Walsh, an atmospheric scientist at the University of Illinois, commented that "If the permafrost melts, it becomes a soggy surface; it becomes impossible to drive on. There are important implications of buildings are on top of it."

A half-mile section of road near the town of Fairbanks has collapsed. Permafrost melts more readily under road surfaces because asphalt absorbs sunlight, which warms the soil below. Eskimos at Kipnuk, a coastal village in the south on the Bering Sea, observe that the area may be sinking because of the warming of the warming of the permafrost.

Kipnuk is a treeless area where five-hundred people live among hundreds of lakes at only five feet above sea-level. Ian Parks, head of Chief Paul Memorial School, says that some buildings in the village are becoming unstable–cracks appear in walls, doors stick, and floors rise and fall.

Elsewhere in the state, bumps are appear-

ing in roads and parts of forests are beginning to collapse. Barry Rock, University of New Hampshire, tells of the damage: "There is so much permafrost melting, I could not leave Fairbanks without going off the paved roads. I had to go around collapsed areas of pavement — in many places, I saw ten to fifteen-foot holes.

Records of warm summer days in Nome, Alaska, show a sharp increase starting in the mid-1970s. Professor Tom Ostercamp, of the University of Alaska, who has studied the permafrost for 25 years, found that all of the permafrost south of the Yukon River was warming. He has drilled a network of one-inch holes across the state and has found a steady melting of permafrost.

In 1989, at a site near the Stampede Trail in Healy, the temperature just below the surface of the ground was –1.27°C. The next year, it had risen to –1.07°C, and last year, it was –0.7°C. Computer models predicted a warming of 3°C to 5°C in the next fifty years. This kind of change has a devastating effect on the forest its self. Glen Juday, a professor of forest sciences at the University of Alaska, claims that if the damage to trees continues as severely as it has, there remains "a serious question of whether any kind of a forest resembling what we've got now will continue." He explained that, as well as damage to forests, there was also extensive damage to roads, building foundations, and airport runways.

PHOTO: LYNDSEY A. INGRAM

Chugaen mountains, Alaska

Across the border in Canada, there have been about close two thousand landslides at the Mackenzie River because of melting permafrost. Professor Walsh said that noticeable glacier retreat in Alaska was seen earlier this year. He remarked, "The impacts in other areas are more subtle, for example, an increase in the frequency of severe weather events." RE

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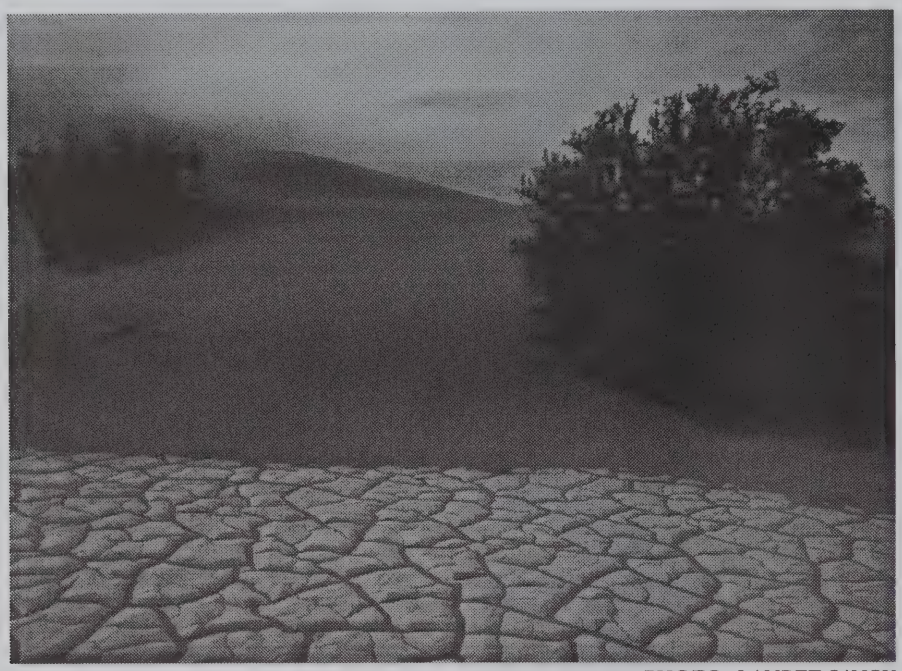

PHOTO: LAURET SAVOY

Airborne dust

Fertilizer of forests through the ages?

BY HERSTER BARRES, PH.D.

In "Dust deposition in Southern Nevada and California, 1984-1989: relations to climate, source area, and lithology" in the *Journal of Geophysical Research*, v. 100 D5, p. 8893-8918, the authors explain how they collected dust in traps on 55 sites in southern Nevada and California to study modern rates of dust deposition, grain size, and mineralogical and chemical composition.

An abstract of this work states: "The average silt-plus-clay (in)flux in southern Nevada and southeastern California ranges from 4.3 to 15.7 g/m2/yr, but in southwestern California the average flux is as high as 30 g/m2/yr." Great care was taken to get representative results. The traps to collect dust were set at 2 m above the ground to avoid particles traveling by saltation (bouncing). Birds and their droppings were excluded through modifications in traps.

While the area studied is possibly dustier than others the authors state that (1) Dust generation is a direct result of aridification and thus it mirrors the effects of climatic change and of human impact on dust-prone areas. (2) Dust has been shown to be a major component of soils in both arid and humid areas. Dust is important to soil fertility and can control the chemistry of precipitation.

If we take these influx values as valid for at least this area, the importance of dust deposition can be seen by calculating the gross influx over 1,000 years by multiplying this initial data by 1,000. In this sense, the influx was 4.3 to 15.7 kilograms/m^2/1,000 years, not an insignificant amount if we refer to trace elements and the fact that some deposition is happening all the time. Remember, this is per square meter. On a hectare basis, the values would be 43,000 kg to 157,000 kg/ha/1,000 years. That's equivalent to about 37,250 to 136,000 lbs/acre/1,000 years, or, finally, 37 to 136 lbs/acre/yr.

While the areas measured may represent areas presently dustier than the Northeast, it is probable that we who live in forested areas are not in the geological period of during which the most dust was deposited. During other geologic periods, the formation of glacial outwash plains, subsequently exposed by sea level changes, were certainly major sources of dust.

According to the U. S. Geological Survey Global Change Research Program, the present volume of the Earth's glacier ice, if totally melted, represents 80 meters in sea-level rise. From minimum (an interglacial epoch) to maximum (an ice-age epoch) volume of glacier ice on the continents, sea level change has a range of 200 meters. For example, during the last glacial peak, about 20,000 years ago, sea level is estimated to have been 120 meters lower than it is today. During a warmer climatic interval in the last interglacial period, 125,000 years ago, sea level was 6 meters higher than it is today. During an even warmer interval 3 million years ago, sea level is estimated to have been 25 to 50 meters higher.

Given that ocean bottoms exposed during these shifts are composed mainly of fine sediments, the potential for moving significant amounts of dust, partially illustrated by the Nevada/California study, is very great.

Finally, in areas less arid than Nevada or California, in which higher rainfall allows forests to grow, there is very possibly the factor of forest fires and the deposition of windborne ash and smoke particles. Up to the time of modern man, forest fires periodically raged unchecked throughout large areas, a function of occasional very dry seasons, the buildup of wood fuel and lightning strikes. Thus, the example of the mentioned measurements, the drastic changes of sea level changes in creating outwash plains, and forest fires and ash deposition indicate a serious role for airborne dust in influencing the fertility of our forests during the ages. RE

References

1) http://geochange.er.usgs.gov/pub/info/whatsnew.html

Forestry

ABOUT THIS SECTION

- Reforestation efforts around the world
- Creation of nursery industry — remineralization movement partnerships
- Unified efforts toward forest ecology education and informing politicians of remineralization

"Believe one who knows: You will find something greater in the woods than books. Trees and stones will teach you that which you can never learn from the masters."

—St. Bernard of Clairvaux

Men of The Trees

Australian soils: relics of pre–Ice Age times

By Barrie Oldfield

In ***Remineralize The Earth*** issue 10–11, page 44, Dan Hemenway comments upon the work and results of rock dust trials in Western Australia. To quote "...We might see greater yields from soil amendments if there had been a regular program of plowing down succulent green manures..."

Yes, indeed, we might! But let's try to understand the situation first.

The soils of Western Australia are incredibly old. Australia, being too close to the equator, missed out on the glacial events which covered most of the plant nutrients in the appearance of the native vegetation which over the millennia has adapted to scavenging for every last nutritious atom and molecule, with the assistance of mycorrhiza.

Soils are shallow, often with highly mobile pH which can move rapidly down to 3.8 due to lack of buffering. They compact under the effect of rain, cultivation and traf-

fic by sheep or farm equipment. Summers are hot and arid. In most seasons no rain whatsoever falls between late October and early May. Temperature often exceed 40 degrees Celsius whilst the drying winds blow at ankle height across unprotected plains desiccating any stubble or organic matter that may remain after harvest.

Dryland Salinity, Our Most Urgent Environment Problem

There is also a problem of rising salinity which is now taking land out of production at the rate of 100,000 hectares a year. Salinity is aggravated in Western Australia by the geological land form, the climate, and the practice of a European style of agriculture.

Farmers are under pressure here, as everywhere, to remain solvent. We cannot do anything to improve the land or soil if farmers walk off and the banks foreclose.

In trying to preserve a modicum of structure in the soil farmers do not plow. In fact minimum or zero tillage is the rule for good farming. The idea of 'plowing down succulent green manures' is a dream, even in midwinter, when a reasonable green cover might be expected, it would be grown as essential stock feed.

There are also other practical problems which only time can reveal. Moraine gravel is unheard of here. Naturally enough, we never had the glaciers to make them.

The country is vast, its population sparse. Perth, the main center of the population in Western Australia, is at least 100 km from the nearest wheat farm, and people certainly don't go joy-riding in the wheat farming country. Pleasure seekers stick to the relatively lush and wooded coastal plains, beaches, and the high forests of the South West corner. So there is a problem of ignorance and the consequent lack of political clout to get things done. 82 percent of Western Australia's population have no idea of the problems faced by farmers, or the extent of salinity.

The role of Men of The Trees

It is therefore left to a small band of volunteers, the Men of The Trees, to help build understanding, and to tackle the problems by working alongside willing farmers in the best way we know how — planting trees — 657,000 of them in 1997.

Back to rock dust

In order for young tree seedlings to survive the rigors of this country we have devoted a lot of time and energy coupled with experience to raising the healthiest, fastest growing, seedlings possible. In this work we have found granite rock dust to have given us excellent and consistent results as a component of the potting mix.

Can rock dust help in the field? That is the ongoing challenge and one for which pertinent comment from experience in the stressed country is most valuable. RE

Another clue from Austria

Paramagnetic effects of granite rock dust are shown in seedling germination study

BY BARRIE OLDFIELD
President of Men of the Trees,
Western Australia

EARLY IN 1997, a simple experiment was initiated involving the propagation of 80 tree seedlings. It was to raise awareness among the more conservative scientific thinkers on our group that rock dust might have a calming effect on plants exposed to electromagnetic radiation. Put simply, rock dust might have benefits beyond plant nutrition, or improvement of the physical and biological properties of the soil.

The rock dust had mainly a 'regulating' role to play — rather in the way that a quartz crystal (the major component of granite) enables your watch to keep accurate time.

Our friends in Austria, notably Dr. Maria Felsenreich and her group, had long insisted that rock dust and other things including rocks, shells and water had a profound effect on the living energies of plants, animals and man. There were resonance factors about life which were going awry with all our modern-day electromagnetic radiation (EMR). Resonance fields set up by cellular telephones, radar, domestic wiring, high tension power lines, atomic accidents, microwave ovens, and radio and television transmitters were working against the steady and very regular EMR that had been around since the beginning of evolution. All this smog of electro-pollution has arisen in the last few decades. Probably the worst effect is the thinning of the ozone layer and the wider window in the upper atmosphere that now lets in far more of the sun's radiation (EMR) than ever before.

Could this 'chaoticized' radiation be responsible for so much of the ill health and the declining quality of our biosphere? Convinced they are on the right track, even more, convinced they have simple remedies for the problems, the 'Austrians' have been traveling far and wide encouraging others to listen, to study their methods, and to participate if they have the skill and sensitivity to do so.

Giving the theory a fair trial

Men of The Trees in Western Australia is a Society of volunteers. They plant around 600,000 trees a years in the semi-arid farmlands of the State to combat wind erosion and salinity problems. Since 1994, members

have helped in building international cooperation through paying visits to Austria, and through hosting visits to Australia by Dr. Felsenreich and her friends. Trees need every help they can get to thrive under these very stressed conditions. Society members were saying, "If the tree seedlings can be given protection from the fierce solar stress, then let's do it!"

As early as 1991, Men of The Trees showed that granite rock dust could stimulate the healthy growth of seedlings from the moment of germination through to planting out in the country. Exactly how rock dust works remains largely a mystery, although many people hold firm views on the subject. However, the Society continues with its observations and trials and publishes all its results.

The Austrian practices gave a special challenge.

It seemed that the rock dust had mainly a 'regulating' role to play — rather in the way that a quartz crystal (the major component of granite) enables your watch to keep accurate time. A trial was set up in which the rock dust that packed in small plastic envelopes and sealed before being slipped down the side of the pots containing the potting mix and seed. The dust therefore remained perfectly dry and out of contact with the roots and soil throughout the trial. A species of tree was sown which is not easy to germinate or raise, *Acacia scirpifolia*.

If the rock dust was going to have a remote effect, then surely this difficult test would give an indication.

The 40 pots on the left were treated. The 40 pots on the right are control. There have been many plant failures (failure to germinate and failure to survive). However, it is clear that survivors in the treated pots exceed those in the controls.

Let's replicate the trial

The results are interesting. One might almost say 'tantalizing'.

At this stage one can say it is an isolated observation. To be of real interest,further research should apply rock dust to local plants. If we replicate this observation it will certainly open up a new field of experimentation which might well lead to a better understanding of the global effect of today's EMR and steps we should take to minimize risk to health, not only of trees, but of people also.

Experiment: To explore possible non-nutrient, non-physical contact effects of rock dust on the germination and growth of tree seedlings.

Background: Observations by workers in Austria and elsewhere have linked electromagnetic radiation (EMR) with ill health in forests, landscapes, animals and human beings. A century ago, background EMR was confined to solar radiation during the day and a very low level of radiation from the radioactive elements found in the earth's crust. It is virtually only during the past 70 years that man-made EMR has become a factor to be reckoned with in out biosphere, universally present in a wide range of frequencies and strengths, day and night. Compared with the first two decades of this century, we now live in a virtual smog of EMR. Little is known about the effects this may have upon the body radiation common to all living beings, plants and animals, but many observers fear the worst and they are attracting a growing band of followers.

Our way of life has become so dependent on telecommunications, it is inconceivable that we should close down our radio, television, cellular phones, radar. So, the

observers are now exploring ways in which we might protect ourselves. One practical way is to wear a small pouch which contains a blend of certain rock dusts. Whilst this experiment does not endorse the effectiveness of such a pouch, the principle can be applied, nevertheless, to the raising of tree seedlings.

Method: A total of eighty tree seedlings were seeded in individual pots at Lesmurdie on Monday, 13 January 1997. In each of forty of the pots a small plastic envelope was placed containing 6g of granite rock dust from the Pioneer Herne Hill Quarry. Each envelope was sealed and placed down the side of the pots as the potting mix was packed in. The potting mix was a standard mix from Richgro, made up to the Men of The Trees formula but lacking the usual rock dust fraction. The remaining forty pots were controls. The species seeded was Acacia scirpifolia.

Comment: No attempt was made to randomize this trial. If the rock dust does indeed have a non-tactile effect on the seedling growth or health, then its effect may pass through the side of the plastic pot and influence the seedlings close by. At this stage, the experiment is merely a method of forming a preliminary observation. Should an effect become visible, further experiments will be devised to investigate the phenomenon more scientifically.

Only one species of tree has been seeded, as it is considered preferable to have a greater range of replication than a spread of tree species. However, the choice of Acacia is intentional as trees of this genus have repeatedly shown the greatest response to rock dust treatment in the past.

The seedling trays will be transferred to St. Barbe Grove within three days of seeding where the nursery regime of watering, sunshine hours, shadecloth density, etc. are uniform with other rock dust trials.

	TREATED	CONTROL
Percentage survivors:	57.5%	15%
Total survivors:	23	6

Results and Observations from the trial: The 40 pots on the left (see photo, page 19) were treated. The 40 pots on the right are control. There have been many plant failures (failure to germinate and failure to survive). However, it is clear that survivors in the treated pots exceed those in the controls.

Conclusion: There is an indication of remote plant stimulation by rock dust worth further investigation.

If you would like to receive copies of the Men of The Trees rock dust reports please write to: Barrie Oldfield, Men of The Trees, 3 Over Avenue, Lesmurdie, Western Australia 6076.

There is no charge to be on our mailing list, but exchange information would be welcome. Dr. Maria Felsenreich can be contacted at : Gartnerhof, A-2230 Gansendorf-Sud, Hochwaldstr 37, Austria. RE

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New chapters founded; new partnerships forged

Champion Trees Project Update

BY DAVID YARROW

New National Champion Elm

The most exciting 1997 event for the Project was discovery of a new National Champion American Elm just miles from David Milarch's home. Evelyn Sika, a Copemish neighbor took a reluctant and doubting David to see this giant in a cornfield. "I thought chances of a State — let alone National — Champion were nearly nil," remembered David. "But when I saw it, I almost fainted."

After standing silent and unseen over 400 years, this 112-foot giant was measured and registered last summer. Ten feet above ground, its 23½ foot girth splits into twelve separate trunks, each as large as an ordinary tree. Dr. Woody Ehrle, Michigan's Big Tree coordinator, scored the tree at 423 points.

This tree is significant because the American Elm is our second most endangered native tree. Only American Chestnut is more threatened. Elms died rapidly from Dutch elm disease spread by bark-boring beetle and capillary-choking fungus that appeared after World War Two. Over three-quarters of American elms — the nation's favorite shade tree — died in the 1950s, and most survivors are declining.

This new Champion Elm, however, is

Left: Champion clone seedlings in the Accelerator®. Inset: National Champion American Elm, with a height of 112 ft, girth of 23.5 ft, and an average crown spread of 115 ft. Buckley, Michigan.

PHOTO: DAVID YARROW

Florida State Champion Shaving Brush

healthy, vigorous, and shows no sign of affliction—past or present. We hope this tree possesses immunity or resistance to the Dutch elm death, and that this quality can be passed on genetically. This is precisely one key reason why the Project was founded: to locate, preserve and study genetically superior trees.

This happy event is tinged with sadness, however. The previous National Champion American Elm in Louisville, Kansas had a score of 435, but was dethroned by both natural and man-made disasters. First it was struck by lightning, then firebombed by a vandal. There were no cloned cuttings to preserve this tremendous elder. This giant's tragic fall from grace highlights the need to protect these great old trees, and to preserve and propagate them before they perish.

Doug Chapman, Director at DOW Botanical Gardens in Midlands, Michigan took a few cuttings from the Michigan Elm. A few were shared with Dr. Denny Townsend at the National Arboretum (Maryland) and Dr. Eugene Smalley at University of Wisconsin (Madison), national expert on American Elm. While Dr. Smalley doubts any tree has immunity to Dutch Elm disease, he may rate this new Champion high for resistance.

This spring, perhaps 200 small saplings of this tree will be ready for planting in the first Living Libraries. Next, we must find scientists and graduate students inspired to study its genes.

Florida Chapter Founded

February 1, 1997, under the National Champion Sacred Bo tree, David Milarch and David Yarrow held a press conference at Marie Selby Botanical Gardens in Sarasota to form a Florida Champion Tree Project (FCTP). Florida ranks first of all states with 146 National Champions.

After this west coast event Terry Mock, founder and former president of the Florida Native Plant Society, hosted a second press conference on March 5 in Palm Beach. Afterward, David and Terry toured the state speaking to tree, nursery and forestry groups. Thanks to Terry's active and effective advocacy, interest in Florida Champions is running high.

Financial support came from Accelerator Growers Association (AGA), a "nationwide network using new horticultural technology to grow the highest quality trees in the world." As AGA's Marketing Director, Terry Mock says, " AGA and FCTP are natural partners because genetically superior trees should be grown with advanced technology to insure optimal long-term results." AGA growers pledged production capacity to produce one million Champion Trees.

After the press conference, David Milarch and Terry Mock toured the state to spread the word. Among their destinations: International Society of Arboriculture; Florida Urban Forestry Council, and the Tampa Horticultural Exposition hosting executives that represent municipal tree boards, golf courses and landscape architects. Their final meeting was with the Board of Directors of Florida Native Plant Society, where a new book on Florida Champions was announced: "Big Trees: The Florida Register" by Dr. Daniel Ward and Robert T. Ing.

The Horticulture Society of South Florida endorsed the Project, and is working to secure funding and safe havens for Archival Living Libraries. Potential sites include public and private golf courses, Flamingo Gardens, Walt Disney World, and Pigeon Key Foundation's island research facility in the Florida Keys.

The International Society of Arboriculture (ISA) is a global network of shade tree growers, surgeons, researchers, and scientists. As tree grower representative on ISA's Florida chapter board, Terry Mock mapped strategy to ISA for nursery industry's long-term regional sustainability. ISA is enthusiastic, and is reviewing how to become more involved.

With a letter from Governor Lawton Chiles, Terry presented the Project to the Governor's Commission for a Sustainable South Florida (industry, environmental and political leaders that set long-term policy for America's fastest growing region). Commission Chair Richard Pettigrew acknowledged, "Trees are an important component of our urban areas, enhancing the landscape, counteracting effects of pollution, and assuring success of long-range sustainability goals."

Nationwide, interest in the Project has begun to materialize. The Lerio Corporation, the number-one U.S. producer of nursery containers, is committed to addressing the market's needs for higher quality trees. Lerio President Mark Christian and Terry Mock made a nationwide trade show tour to introduce The Accelerator air-root pruning system. Terry reports, "Everywhere, from Florida to Oregon, there is strong interest to improve tree quality by better production methods and superior genetics. We identified partners in key states across the country."

Michigan Champion Tree Protection Act

On Earth Day, a Michigan Champion Tree Protection Act—the first of its kind in America — was introduced to Michigan's Legislature by State Representative Bill Bobier and State Senator George McManus. This bill will bring these great trees — our key allies in evolution, climate control and greenhouse gas removal — under legal shelter and sanction. With 23 sponsors and enthusiastic response, this pioneering bill will easily work its way through the legislative machine and pass in 1999.

The best protection for Champion Trees is public recognition and respect. But public benevolence must be reinforced by legal reason and due process. Legislation is needed to:

- Recognize our public trust in this fragile, perishable resource;
- Initiate activities to preserve and study their unique legacy;
- Set procedures for removal;
- Fix penalties for damage or destruction of a Champion.

The Michigan Champion Tree Protection Act:

- Establishes legal recognition of Champion, Co-champion, and Candidate Champion Trees;
- Directs the Dept. of Natural Resources, through its State Forester, to maintain a list of Champion Trees;
- Sets criteria to rank trees as Champions;
- Provides for preservation, propagation and study of these trees and their genetic resources;
- Prevents any listed tree from being taken by anyone unless a threat exists to life and public property;
- Requires that before a Champion is removed, cuttings or tissues must be propagated;
- Defines unlawful destruction of a Champion as a felony, with fines and penalties;
- In addition, some want to amend the Act to make May 1 Champion Tree Day in the State of Michigan.

PHOTO: DAVID MILARCH

National Champion American Elm's massive trunk spreads into its characteristic vase shape, providing ample shade

In August 1996, David Milarch and his two sons shipped buds cut from five Michigan Champion trees to the J. Frank Schmidt and Co. nursery in Boring, Oregon, America's largest container shade tree company, selling over 5 million trees a year.

Schmidt's grafted and grew these buds from Michigan. In twelve months (five months of growth), 12-inch cuttings grew to

PHOTO: DAVID MILARCH

Jared Milarch standing next to a National Champion Red Maple

six to nine foot saplings! This extra-ordinary growth got Keith Warren to see firsthand results of the first Michigan Champions. Discussing national strategy to develop and market Champion Trees, Keith Warren said, "It's obvious now we can establish and produce trees from budwood of original parents. All four species produced strong growth and good form. They look like viable commercial nursery products."

Michigan chapter President David Milarch flew to Oregon in December to hear how excited Schmidt's is of prospects to grow and market Champions. The nursery wants to invest significant capital and resources to trademark, propagate and market all five Michigan Champions they currently grow. They will generate the volume of saplings and promotion for national markets. Michigan Champion Tree Project, owner of the plant materials, will get $1 royalty for each trademark Champion Tree sold.

Schmidt's will review the list of Michigan's other Champion Trees, and indicate which can develop into nursery products. Schmidt's will offer $1 per tree for others with commercial potential. Schmidt's has interests in an Oregon horticulture lab, and will investigate cloning Champion Trees by tissue culture.

Further, Schmidt's will cooperate to develop all National and State Champions native to the Northern climate zone into trademark trees to market nationwide. State chapters are invited to send Schmidt's their Big Tree list. Schmidt's will indicate commercially valuable varieties they can include in their selections, and accept buds to root/graft into specimens in their nursery. If a tree shows commercial potential, Schmidt's will offer the same trademark royalties to any state chapter.

With successful initial test propagation and marketing, we are counting on long-term demand for higher quality trees to sustain the Project through the years of trial and error that lie ahead.

1997 Champion Bud Harvest

Unfortunately, few new trees were harvested for buds and none for seeds in 1997 — the Project's second year. Yet, progress was made to preserve our Big Trees as four new varieties were added to the list of cloned Michigan Champions:

- National Champion American Elm in Buckley, Michigan. (*Ulmus americana*, 423 points) (see previous page)
- National Champion Green Buttonwood: on Earth Day 1997, this Florida Champion in the Town of Palm Beach, Palm Beach County, was cloned by AGA

nurseryman, Jim Henry. This hardy tropical native was chosen due to its imminent extinction from an incurable root rot diagnosed by local testing labs.

- National Champion Shavingbrush tree in Boynton Beach, Palm Beach County, Florida. This spectacular exotic was chosen because of its incredible flowers and colorful leaves. (See facing page)
- National Champion Black Ash (*Fraxinus nigra*, 281 points) in Adrian, Michigan joined five other Michigan Champions now being propagated by Schmidt's Nursery in Oregon. Black Ash is very valued by native Americans, who use its wood for splints to weave baskets. Thanks to Michigan's Big Tree coordinator, Dr. Woody Ehrle, for accomplishing this task.

A small quantity of both Florida Champions are being propagated by AGA grower Jim Henry at the "Butterfly's Are Free" Nursery for ceremonial use, and as a source of future cuttings. The cuttings are now a foot tall and fully rooted in Accelerator® containers. However, it's generally not good to plant clones at such small size. Survival is better if they're kept in the nursery a few years before planting out.

Plans are underway for a more abundant harvest of Champion budwood and seeds in 1998. We hope by year's end over two dozen National Champions and several State Champions will be in propagation, and ready to plant in Living Libraries in 1999.

Founding Members: Plant your own Champion

Chapters have been started in three states so far: In July, 1996, The Champion Tree Project was incorporated in Michigan; A second chapter was incorporated in Florida in March, 1997; and a third in New York in November, 1997.

In 1998, we expect chapters to form in other states to give the Project national scope. Anticipating emergence nationwide, the Project offers $25 Founding Memberships to individuals and families who join this year. These early-bird Founders will get to select their own tree from Champion saplings available publicly.

In the next four years, many Champion Trees will be preserved by plantings in Living Libraries. As more trees are propagated, saplings will become available to the public. Founding Members will get first choice of these trees.

Project Website: Champion Trees on the Internet

In August, Dan Winter of the San Graal School for Sacred Geometry in Asheville, North Carolina, donated disk space on his web server to the Project. David Yarrow of Turtle EyeLand in Albany, NY, wrote text and code to begin a Champion Tree website on the Internet. The URL to access the homepage is:

http://www.danwinter.com/Champion Trees/

Currently the site is a simple, no frills, no thrills information resource of nearly 50 documents, including a new members page, state chapter information, how to start a chapter, the Michigan Champion Tree

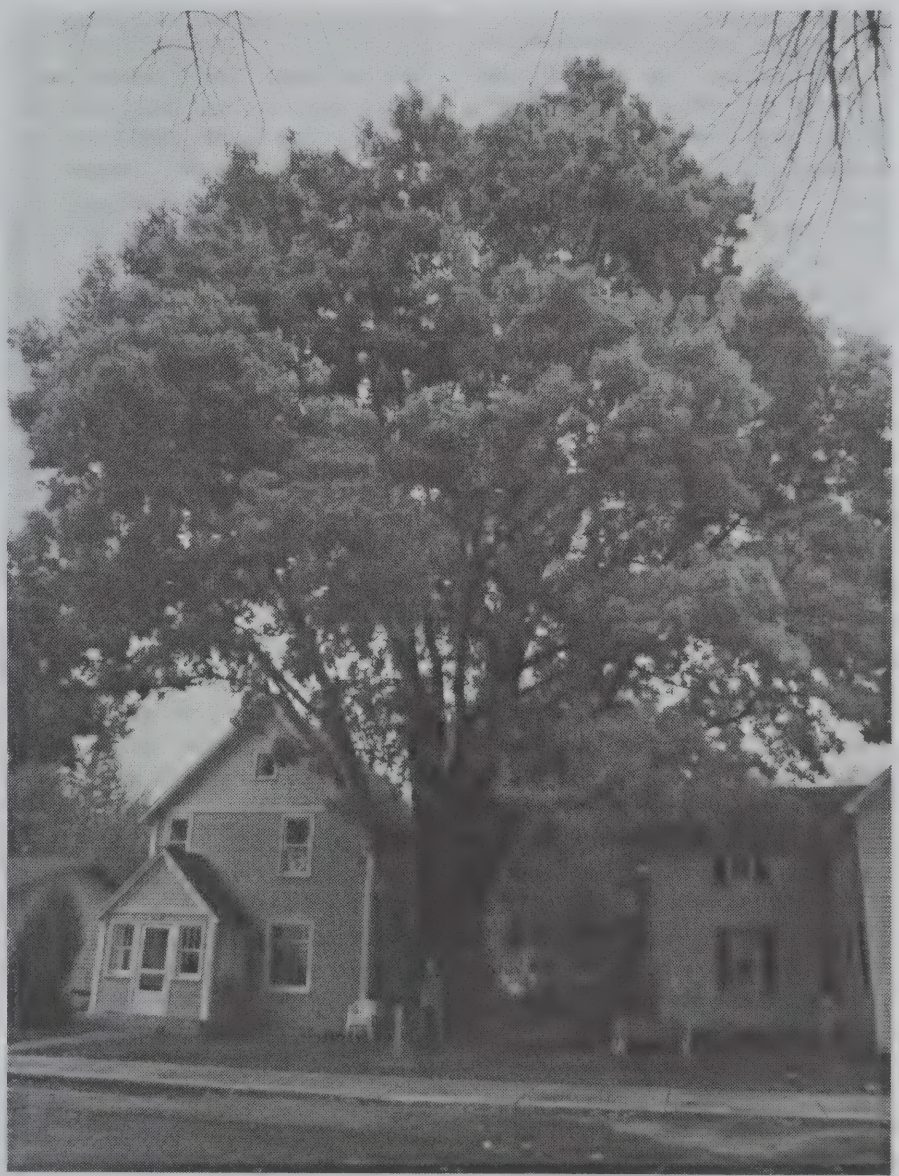


PHOTO: DAVID YARROW

National Champion Norway Maple, Cloned August 10, 1996.

Protection Act, guidelines for planting a Living Library, rockdust product lists, and more. Lee and Paula Nowack of Traverse City, Michigan were the first people to enroll as Founding Members from this website.

In the upcoming year, the goal is to develop a theme and framework for an educational website for children — a series of screens for distinct age ranges to teach them about trees, forest, ecology, and stewardship. Some of this information and instruction is already available on-line at other sites to be linked to the Project site.

Contributions and suggestions to improve the Project website are appreciated. Currently we need photos of Champion Trees and relevant graphics. We also want to develop links to other information resources, programs and groups on the web, and master use of the web as organizing tool for a nationwide effort.

New York: Living Libraries to Living Classrooms

In July 1997, meetings began in Syracuse, New York at the College of Environmental Science and Forestry of the State University of NY, guided by David Yarrow and hosted by Dr. Sue Senecah in the Environmental Studies Dept. A New York chapter was incorporated in November, with nine Board members from five regions of the state. Because NY is so diversified in population, geology and ecology, the NY chapter is organized with regional subchapters and representation.
The NY chapter's first goal is to establish Living Libraries to plant Champion clones beginning Spring, 1998. A 48-page information packet was developed toward that goal. In November, invitations to begin plantings in spring, 1998, were mailed to a dozen sponsors around the state and the chapter members began discussions to enroll each site as a Champion archive. The current list of accepted sites is as follows:

- SUNY College of Env. Science and Forestry, Syracuse
- Peace Pagoda and Free School, Grafton (Taconic Mountains)
- Powmatuck Farm, Cambridge (Green Mountain foothills)
- Petrified Sea Gardens National Landmark, Saratoga Springs
- Kanatsiohareke, Fonda (Mohawk River Valley)

While NY has a great diversity of population and geography, unlike Florida and Michigan, the Empire State isn't blessed with many National Champions. NY only has 14, although several are of commercial and cultural value.

However, the NY chapter identified education as its principal goal for program development. Several Living Library sites offer opportunities to create "Living Classrooms." In the next year, St. Lawrence University and the Albany Free School will explore activities to involve children and youth in learning about trees, forests, ecology, and stewardship. Soon we hope to plant Living Libraries at all 64 State University of NY campuses — first step toward Living Classrooms at each institution.

The goal for 1998 is to explore in preliminary ways the needs of children and methods for interactive educational curriculum. Insights gained this year provide a foundation to design and plan a comprehensive effort in 1999. Other NY Living Libraries have potential to develop educational programs, and each site affords a unique context to tailor theme, content and methods.

National Science Foundation Concept Paper

After Thanksgiving, Michigan member Frank Wheeler and NY founder David Yarrow combined talents, and ideas of many others, in a 5-page concept paper submitted to the National Science Foundation. While discussions with NSF staff are still preliminary, the Concept Paper calls for the Project to ally itself with other tree and forest organizations to develop educational tools to teach ecological stewardship to American youth.
Through this winter, we will draft a funding proposal to meet NSF guidelines and criteria. We expect by spring to have a plan and budgets detailed to clarify cooperation with NSF to achieve the Project's preservation and education goals.

Maine: Botanical Conservatory

To finish our year, in December we heard from Maine, our northeastmost state. Bruce Sky Walker has begun a Living Library in his region, and will begin to organize a Maine chapter:

"We have a working botanical conservatory, cultivating champion trees and specimen plants which grow worldwide in this latitude. We are building a living heritage library to teach their intrinsic value, and to demonstrate different ways these botanicals are grown and used in other cultures and countries, including their mercantile value as fiber, paper, pulp, seeds, lumber, medicinal, herbal, ornamental, food value — as well as to find new uses.

For more information, contact:
Bruce Sky Walker, site manager
Allcorp Trust Unlimited, P.O. Box 220, Thorndike, ME 04986
phone and fax: 207-568-3139;
email: skywalker@uninets.net

"Our goal is to create new entrepreneurial activity in our immediate community and in North America arising from the profitable cultivation and marketing of these natural botanicals. We will increase public appreciation of these botanicals by introducing them in an attractive educational setting, thereby insuring the longevity of champion botanical stock for our grandchildren to enjoy and use.

"We are founding a Maine chapter of the Champion Tree Project, which recognizes the virtues and need to protect, preserve and propagate our Big Trees. The first Champion Tree sapling planted in Maine will be on these lands."

Disaster: Ice Storm of the Century

January 8, 1998 warm moist tropic air boiled north in thick plumes to roll over a heavy arctic air mass stalled along the St. Lawrence Valley. Heavy rain fell through colder lower polar air, and, striking any object, froze instantly. For four days this weather stalled as inches of ice caked trees, cars, homes, bushes, streets from Lake Ontario to the St. Lawrence Gulf. Trees limbs were stripped, ripping down powerlines. In

northern New York and New England, hundreds of thousands were without power in midwinter. A federal emergency was declared. In Canada, over 2 million were without power, including all of Montreal, in "the greatest natural disaster in Canadian history."

This unprecedented disaster highlights two reasons why the Project was founded. First, these states made no effort to preserve their Champion Trees. Many were damaged in the storm, if not destroyed. Many that survived will weaken and die early deaths due to injuries. The trees and forests will show severe scars for a decade, probably longer.

Second, undoubtedly this bizarre weather was driven by Earth's growing thermal imbalance: global warming induced by greenhouse effect due to fossil fuel combustion emissions. The remedy to the overheated weather engine is to plant trees—the best trees we can find by the best method we can devise.

When spring planting time comes, these residents of northern woods will plant their trees with added import and urgency. Preserving their surviving Big Trees, planting new trees to replace those lost in the storm, and curbing global warming will not be distant news stories, but necessary activism.

National Roundtable and Press Conference

On February 1, 1998 the Project celebrated Champion Tree Day and the Florida chapter's first anniversary with a National Roundtable in Sarasota, Florida. Project organizers and supporters from several states gathered for a few days of friendship, planning, brainstorming, and decisions.

- Saturday, Jan. 31, members met in closed planning session.
- Sunday, press conference at Marie Selby Botanical Gardens.
- Monday, travelled to Pigeon Key to view the facility's native plant restoration, featuring Champion Trees, then brainstormed ideas for youth education, curriculum and teacher training.

Terry Mock and AGA hosted the meeting, with help from Zan Benham of Sarasota Eco-Report. RE

Nature's Cathedrals

Champion Trees Project Spreads its Branches

By Mike Vogel
News Staff Reporter
reprinted from *The Buffalo News*, Sunday, August 3, 1997

Nestled within a high cove scalloped into the edge of Zoar Valleys towering cliffs, the last vestige of virgin forest in Western New York cling to life.

In a hemlock grove in Angola, the regions oldest living creatures turn their needlelike leaves to summer sunlight — as they did decades before Columbus.

On a plateau overlooking Cattaraugus Creek, a giant tree that may be the largest of its kind on the planet sends massive roots into a forest floor.

Treasures long thought lost forever, the woods that once carpeted much of this area haven't vanished completely — at least, not yet.

Treasures long thought lost forever, the woods that once carpeted much of this area haven't vanished completely — at least, not yet

A surprising number of survivors from past centuries have turned up in an ongoing survey that has yet to reach every corner of Western New York. "We found the first virgin forest in New York outside the Adirondack and Catskill preserves," said Bruce Kershner of Western New York Old Growth Forest Survey, a volunteer effort gaining national recognition. "We also found the oldest living things in Western New York that are documented, and we discovered the largest red oak in the world," the botanist and forest ecologist said.

Surprisingly, even for the survey team, all three sites aren't in heavily forested Southern Tier. They're all in Erie County, home to the state's second-biggest city. To date, a five-member group formed at a 1989 meeting of Niagara Frontier Botanical Society has visited over 140 sites. Forty-four turned out to be ancient forests.

Few of those forests, however, come close to matching twigs with an unlikely grove in Angola-by-the-Lake, where slow-growing western hemlock tower skyward. Checking out the site, team members found a recently cut tree with growth rings "like grooves in a vinyl record." Counting, they were stunned to find the hemlock was 515 years old — already past the sapling stage when Columbus reached America.

"I believe it was an 18-inch tree," Kershner said. "And there were 30- or 40-inch trees in the same section. There's no question that this was a smaller one, and there were a lot of larger trees there." Half a millennium isn't a record for this part of the world. Stunted cedars believed over 1,300 years old were found clinging to rocky Niagara Escarpment cliffs in Ontario.

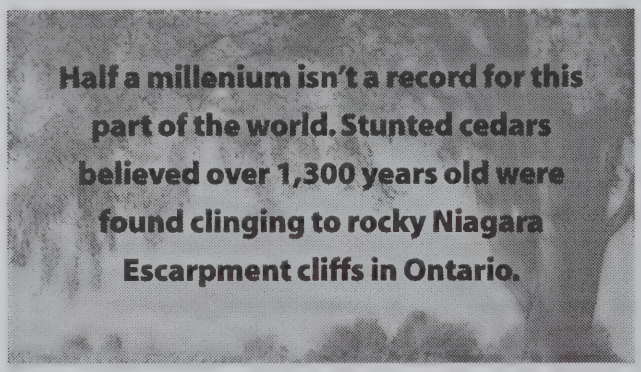
Lacking landowner permission, the survey won't disclose an exact location. The grove, though, covers several acres, and is part of an old-growth forest seen, but not noticed, by scores of people each day. A large number of the region's old growth forests and groves, in fact, are surprisingly exposed and easy to see:

- On the former DeVaux School campus in Niagara Falls, the last remnant of primieval red, white and black oak forest that once lined Niagara River survives as the only upstate old-growth grove within boundaries of a city.
- Lilydale spiritual community adjoins Cassadaga, Leolyn Woods — a mixed grove rivaled only by Portville Cemetery for its tow-

ering, ancient white pines — is home to spiritualist readings and traversed by a path that can probably accommodate wheelchairs.

• Extensive "vertical" old-growth forest covers both sides of Cattaraugus Creek gorge walls at the busy Route 219 bridge just south of Springville, near a scenic parking area.

The survey has roots in an accessible old-growth forest — Reinstein Woods State Nature Preserve in Cheektowaga, where regular tours are held. Kershner was called on to do a four-year study of that 80-acres, at a time when accepted lore held all old forests in this area had been logged. His careful documentation of a forest with trees rooted deep in the 19th century opened a few eyes to the possibilities.


Half a millenium isn't a record for this part of the world. Stunted cedars believed over 1,300 years old were found clinging to rocky Niagara Escarpment cliffs in Ontario.

"We thought, if there's old-growth forest in Cheektowaga, with its densely settled population, there could be other ancient forests in Western New York," Kershner and Williamsville teacher James Battaglia decided to look, and were quickly joined by botanist Michael Siuta. Ecologist Charle Rossenburg and environmental remediation contractor Glen Gelinas soon joined the team.

So far, they've found 500 to 600 acres of old trees scattered throughout the region, and another 600 acres within the largest single forest preserve in the area, Alleghany State Park. Some are in stands of less than an acre, some in groves of up to 20 acres, and some in forests of 20 acres or more — the minimum size to sustain a complete forest ecology.

Old-growth forests generally survive only because they were too inaccessible, too difficult or scrubby for commercial logging that stripped this area in the last century.

This compares with the woods that once carpeted much of this region. The survey calculates, the survivors amount to a tiny fraction of 1 percent — about the equivalent of three half-acre home lots, in the middle of the 67,000-acre Alleghany State Park. And, so far, the survey has found only one "virgin" forest remnant, along the Zoar Valley gorge. "It's called High Cove, part of a 30-acre old-growth forest we found on Erie County's side," he said. "The forest extends along the canyon on either side for some ways."

Hiking through the woods, the team members were stunned as they approached trees towering an unremarkable 709 feet above the cliff edge — and then, on closer inspection, realized the trunks extended another 70 feet down, into a deep bowl-shaped depression set into the edge of a 350-foot cliff.

To be considered old growth, a site has to meet an eight-point checklist of age-indicating items, and it must show little human disturbance for at least the past 150 years. This forest remnant was more than that. It met the team's definition of virgin woodland.

"If any human being has ever been there, he's fallen in by accident, and he hasn't touched anything," Kershner said. "It's nature at its purest. It's been there, like that, for thousands and thousands of years."

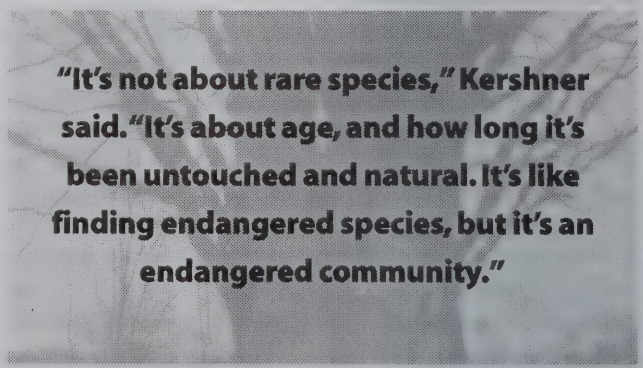
Even though the site can be precisely mapped, it's in the state's Zoar Valley Multiple Use Area, south of Vail Road and midway between Unger and Button roads - reaching it is a hard hike through trackless woods, on a compass bearing. "There's not a single sign a human ever did anything to it. We think a tiny number of human beings have ever been in it," added Kershner, who escorted Dept. of Environmental Conservation officials to the site.

Nearby, in Nature Sanctuary Society's 35-acre William Alexander Preserve, what at first looks like a thicket refuses to separate into tree trunks as hikers near. In fact, it's a massive single trunk — the largest red oak known, dividing into two massive stems just above eye level.

On a bluff overlooking Cattaraugus Creek, the giant is 7 feet 7 inches in diameter a bit larger than the previous National Champion, a solitary oak in a farm field near Rochester. Its age is unknown — like the huge solitary white oak in the middle of Buffalo's Delaware Park Meadow, it is too thick for a complete core boring, and the only way to accurately count its annual growth rings is to cut it down.

The survey team pauses only briefly to pay its homage. There are other trees out there — a Chestnut Oak clinging to the gorge wall may also be a State Champion, and the New York list already include five other Western New York trees, including Erie County's National Champion Staghorn Sumac. More importantly, there are another 44 candidate sites to examine, and entire ancient forests still unexplored.

Old-growth forests are valued for beauty — the "forest cathedral" and the genetic heritage of hardy, long-lived trees and other plant species. "It's not about rare species," Kershner said. "It's about age, and how long it's been untouched and natural. It's like finding endangered species, but it's an endangered community." RE


"It's not about rare species," Kershner said. "It's about age, and how long it's been untouched and natural. It's like finding endangered species, but it's an endangered community."

Forest Briefs

'World Caught Fire', Environmental Group Says

COMPILED BY EMILY HATFIELD
from the Associated Press

LONDON (Dec. 1997) — More tropical forests burned in 1997 than at any time in recorded history, sowing death, respiratory illnesses and pollution, and destroying wildlife habitats, the World Wide Fund for Nature reported.

"This was the year the world caught fire," said Jean-Paul Jeanrenaud, head of WWF's forest program and co-author of the report. "As we destroy forests, we are destroying our insurance for the future."

Up to 12.4 million acres of forest and other land burned in Indonesia and Brazil, where the Amazon region alone had more than 45,000 fires, the group, which used to be called World Wildlife Fund, said in its report. Vast areas of Papua New Guinea, Colombia, Peru, Tanzania, Kenya, Rwanda and other parts of Africa also burned, and large-scale fires were reported in Australia, China, Russia and several Mediterranean countries, the report said.

In his preface to the report, WWF director general Claude Martin, called it "a planetary disaster."

El Niño, the cyclical phenomenon of warming Pacific temperatures that disrupts climate patterns, had delayed monsoon rains which usually extinguish many naturally occurring forest fires, Jeanrenaud said. The 1997 El Niño effect was the worst this century, he said.

At least eighty percent of the fires were set deliberately, often by multinational companies trying to clear land for planting or development, he said. Jeanrenaud cited the growing problems of timber speculation, insurance fraud, arson and setting fires as an act of political defiance, a phenomenon seen in Indonesia and some Mediterranean countries.

The WWF urged governments to set up an international tribunal to punish offenders and to deploy a task forces to intervene in areas where environmental catastrophes are looming. Still, Jeanrenaud acknowledged there was no international consensus to do so. Instead, he reported, the WWF is trying to persuade individual governments to take action. Brazil and twenty other countries now have pledged to protect a minimum of ten percent of all forest types within their borders.

Sacred Trees

Buddhists in Thailand are making a desperate bid to save the country's northern forests from illegal logging by giving the trees religious protection. An alliance of lowland Thai villagers and northern hill tribes is working to save about 800,000 acres of forest.

The Northern Farmer's Network planned to ordain 50 million trees during a two-day celebration last month. The trees were wrapped in orange robes usually worn by Buddhist monks. "It is a ritual to connect people's minds with nature," said monk Phra Somkid Jaranadhammo. The religious ordination of the forests may cause outlaw loggers in the overwhelmingly Buddhist nation to think twice before axing the sacred trees. (2/1-15/97)

Sick Tree Syndrome Hits Europe

Earth Island Journal

BELGIUM (Winter 96-97)—A joint European Union/UN report found that 20% of Europe's trees are shedding at least a quarter of their foliage due to airborne pollution. Scientists reported leaf loss in 18% of trees observed in 1995—up 2.6% from the year before. The greatest damage occurred in Germany, Poland, Slovakia, and the Czech Republic.

— David Yarrow

Defoliation due to airborne pollution plagues many of Europe's forests

Agriculture

ABOUT THIS SECTION

- Remineralizing farms, gardens, and orchards
- Scientific goals and measures, government agencies, industries and businesses from horticulture to permaculture
- Other food and fiber production systems

"Regardless of where it is that people attain excellent health and maximum life, it can be traced to a continual supply of fresh-ground mixed rocks flowing to the soil where their crops are grown."

— John Hamaker
The Survival of Civilization

Mr. Natural

Carrot shaman Bob Cannard grows celebrated designer vegetables in the Golden State

Bob Cannard examines the quality of rock dust recently delivered to his farm.

By Christina Waters
Reprinted from *Metro Santa Cruz*, April 11-17, 1996.

With its unruly hedgerows of peach trees and musical creek meandering down the mountain, Cannard Farms in Sonoma, California, is, by any standard a rustic Eden. It was an exuberant endorsement by Greg Steltenpohl, founder of Odwalla juices, that brought me here: "Bob's carrots are amazing — he's a carrot shaman!" Steltenpohl had put his money where his mouth was, retaining Bob Cannard to develop Odwalla's new 65-acre carrot patch, whence flowed the very roots of the company's ubiquitous carrot juice.

After putting two and two together and realizing that this was the same Bob Cannard who grew some of the most famous designer vegetables in California — those adorning the menu of Alice Waters' Chez Panisse and Wolfgang Puck's Postrio — I had to see for myself.

House wide open, encircled by barns, out buildings, odd bits of weathered tools, a pick-up truck and a small, bouncing puppy — Cannard appears on the rough-hewn front porch like a Wild West apparition. Dressed in mountain man standard issues — flannel shirt, blue jeans, muddied work boots and knit cap — he ushers me in and puts on the

kettle, leaving me to examine the display of beautifully colored rocks lined up in four near rows on the kitchen counter.

"Most people think that rocks are dead," he says, without turning from the sink. "They're alive."

Chunks of amber honeycomb lay oozing in a wooden bowl and outside the window the fields exploded with early spring mustard. We sat down — so help me — at a log table. He is Jeff Bridges by way of Elmer Gantry. Tanned and weathered, Cannard's face is illuminated by sky-blue eyes, his long hair shot through with silver, his body lanky and lean. Shaman or not, he is one heavy dude and the air in his kitchen was soon thick with charisma.

Cannard likes to pontificate about the stupidity and greed of the conventional high-yield farming. He'd also like to wander off in the direction of planetary doom and the destruction of the earth's fecundity. The hippie in him is obliged to inform me that he keeps his phone in the barn. And that he wouldn't even have one if his kids hadn't insisted. So booming are his pronouncements, so maverick his colorful homilies, that I begin to think he's strictly from Central Casting. But later, when we walk the land, smell the soil, sample the results, I realize that he's the real thing.

Maybe somewhere in his mid-40s, Cannard has roamed, worked, loved and improved these 172 acres (30 of which he cultivates) for the past 20 years, during which he also taught classes in garden crop production at Santa Rosa Junior College.

In 1960, the Pennsylvania native arrived in the Santa Rosa area, where his family ran a nursery raising ornamental plants. "That was growing as an industry," he grumps. But at least he was around plants — always loved being around plants. "I went to school at Fresno State and I thought I wanted to study horticulture. But what I was really interested in was plants." He beams paternally. "The ease with which they grew in the wild, their fullness and softness."

Loving that essential plantness of plants, Cannard was disappointed to find "that the educational system was only training you for a job in some industry." Of his formal training, he is willing to recall only that he had "a lot of inquiry, and they suppressed inquiry." So after a brief stay, Cannard ditched academia and in 1972 started Sonoma Mission Gardens.

"I'd been around plants all my life. It didn't make much sense for me to take those basic courses," he observes, careful to sound modest. "I got kicked out because I was too much of a shit disturber," he growls happily. Besides, "plants weren't getting what they wanted from those additives, all those systemic fungicides the petrochemical people used."

So Cannard has spent the past 20 years finding out what plants want and helping them get it.

Dowsing the Right Fantastic

Like the reincarnation of Rudolph Steiner — founder of the biodynamic farming movement currently enjoying recycled vogue — the shit-disturbing grower describes plant cultivation in terms more suited to psychology than chemistry. Dashing up from the table, Cannard bounds out the front door, grabs two handfuls of Italian parsley from different sections of a nearby plot and throws them down on the table when he reappears.

One, I'm invited to realize, is weaker, less vigorous in color and flavor. "It was too easy to pull out, the roots weren't very deep," he instructs. The other, we both agree, has more "integrity". It's bigger, bolder, hard to uproot. What that means to Cannard is that the more luxuriant parsley was well suited to its growing area. "It was happy where it was — it had bonded with that spot."

A firm believer in finding out what makes plants happy, Cannard works by patient observation and keeping an open mind. He also works a bit like P.T. Barnum, treating me to an impromptu performance of another of his plant surveillance methods — vegetable dowsing.

From out of nowhere he produces and old rusty chain. "I dowse with an old chain," he says, flashing a wicked grin, "because I'm just a simple farmer." Right on cue, the dowsing chain makes smooth, pliant circles over the "good" parsley. It stutters in uncertain, short, back-and-forth motions over the weaker herb It's possible that I'm being played for a media fool. It's also possible that Cannard himself is not firmly rooted on this planet. Either way, the good parsley tastes like the Second Coming of Jesus Christ.

"I'm inclined to grow food of its own volition," he says, being cryptic on purpose "It's very much a spiritual venture. I just allow it to be itself." Back at his father's nursery, the plants "were just these little numbers. I'd look at all those thousands of plastic pots and I'd just see money. They weren't individuals."

Twenty year of natural farming — in which Cannard is a collaborator with, not master over, the land, seasons and crops — have taught him otherwise. "Plants aren't deceptive. They don't run away, they don't adorn themselves with trickery," he says evangelically. "They're naked and open. They're passive, generous, willing. ... So we think plants are stupid."

Clearly Cannard does not. "The arrogance of one species deciding that it can administer to another," he fumes, and pours another glass of green tea.

Like many growers who believe that the ideal farm should be conceived as a self-sustaining organism, Cannard feels he improves his farming by getting to know the history and cycles of his crops. "You can see the plant's past by looking at the leaves, seeing the struggles and tribulations, the lean years, the years of flood, in the oldest leaves, or in the growth patterns, the signs of stress within the bark of the tree," he says. "You can see whether it's suffered or whether it's gone through stuff. We can get an understanding of what it was, all the way to where it is now. Once you get grounded in its history, you can figure out what they need. You can create a stress-free environment and you get strong plants." Like the parsley on the table in front of us. "You want to grow food that will connect us in that way with nature."

Jumping up, he herds me out the door. "That's enough writing. Let's walk."

Between a Rock and a Sweet Place

The tour starts with a quick look at a green-

PHOTOS: JOANNA CAMPE

Lettuce give thanks: Cannard kneels among young lettuce in unweeded, remineralized soil, Sonoma, California. Inset: Remineralized potatoes harvested for shipment.

house and drying shed, where huge mounds of wheatgrass destined for Chinese medical healers are yielding up their moisture. Then we stick our hands in silvery hills of soft, powdered igneous Napa Valley rock, whose virtues as a soil enhancer Cannard tirelessly extols. He enjoys recalling a visit from "some of the University of California, Davis, guys who laughed all the way back to Davis about my powdered rock." Cannard claims his critics no longer laugh but are making tectonic shifts over to the powdered rock bandwagon.

The licorice scent of fennel emanates from a steaming row of compost hills. These very hills are most famously known as the ultimate exercise in designer recycling, since they are fed twice a week by the kitchen scraps of Chez Panisse restaurant. These very hills, in turn, are fed back into the fresh produce Cannard is commissioned to grow for the restaurant.

"The people from Chez just brought stuff in — they must have been cooking with fennel last night," he says. In the raised beds we straddle rest perfect miniature bouquets of lettuces, mache, kale, bok choy, mustard, broccoli and raddichio, all impossibly beautiful, all fed by compost.

Cannard's larger growing fields, not the photo opportunity in March that they will be in June, appear to be inundated by high weeds. In fact, the tiny bundles of red chard are all but invisible under their canopy of wild radish free-associating with calendula.

This is one of his master strokes. "I grow one crop for humans, and one crop for the land," he explains. The "weeds" are a blend of native volunteers and last year's crop allowed to bolt. Both cover crops will be mowed and hand turned to replenish nutrients — but only when they're mature. "Plowing immature corps for green manure kills the plant before it's ready — sort of like shooting a teenager." Cannard loves speaking in this sort of provocative soundbite. When he says things like "Phylloxera is a totally insignificant bug — easily cured," you know he's trying to shock.

"Plants secrete sugars and they stimulate bacteria colonies and are sucked up by the plant," says Canard, the teacher. "When you grow crops, you're really cultivating bacteria." Cannard loves the fact that his favorite cover crop of weeds is both free and native. Sure, it might slow down the pace of the growth or affect yield.

He makes no bones about his farm not growing big bucks, the way the Evil Petrochemical Empire does. "Their way of improving soil with imported commercial fertilizers or composts costs many times more than mine, with weds and powered rock," he points out. "My way is much cheaper and doesn't need rigs, applicators, chemicals." Bombast softens when he admits that his style involves "a different pace. It's a little slower. And it's sure as hell more labor-intensive."

Cannard's hand-cultivated harvest are invariably smaller, as well. "With commercial additives you can harvest 50 tons to the acre," he says "but those vegetables have been sprayed, weakened. I can only get 12 tons to

the acre. I can't compete on the quantitative level."

Picking leaves from time to time, stretching, pulling, feeling for strength, he admits, "There's hardly any money in agriculture." At least not the way he does it.

"I used to do farmers' markets," he says as we ford a stream and swing past barrels of wine vinegar being made in the shade of towering live oaks. "They worked well for me — it was cash money. But I was approached by Alice's dad to grow for the restaurant. They interviewed 17 farmers [actually it was 10] and picked me." Grin. "Now they come twice a week, three times in the summer, and they bring compost. I pick what they've ordered and box it. They drive it back to the restaurant."

Now he's given up farmers' market and stopped teaching, too. He grows vegetables for Chez Panisse and Postrio, carrots for Odwalla on acreage seven miles from this farm, and some pinot noir grapes in vineyards nearby. He is also starting an ambitions olive orchard. Consulting about weeds and soil to other farmers and vineyards brings in most of the $100,000 he'll make to support himself and two workers in a good year.

"Color can tell me a lot too," he says sitting me down among the huge fava-bean blossoms and tiny heads of teal-green lacinato kale. Lady bugs cling to chartreuse tangles of frisee. The oak leaf lettuce shimers. "A lot of this is wild," he says. "It's reseeded stuff from the last crop — and it's pickable for free. This land has tremendous depth. Even the things that didn't work helped teach me something for next time."

Vibrating Landscape

For a man with an ego as large as his land, Cannard is remarkably candid about his trial-and-error experiments. "Not everything works," he smiles pointing to the frost-damaged corpses of infant purple-top turnips. "And it's constant work." We smell the fragrance of soil that has been so personally tended. Even the gone-to-seed heads of arugula are pungent without a trace of bitterness.

On our way towards a sunny slope where bee houses of Cannard's own hexagonal design hum with activity, he points excitedly, "There's where we picked the lettuce and got a second cover crop for mulching." You sense that after all these years, he's still discovering what the land can do — when it wants to. Whatever — and however — Cannard does what he does, it works. This land is so alive it practically vibrates.

Bob Cannard does not vacation in Tuscany. "I'm always here. What I love to do is take care of it all," he says. "That mountain up there, and the creeks." He wants to restore the balance and health lost to logging and erosion, "We're running at 40 percent life capacity in this land since the white man came."

The mountain is especially important, he says. "Small handfuls of the tea of the mountain are what really grow everything here. All the bacteria, the minerals are in solution and flood onto the land." Cannard is a firm believer in recycling nature's own nutrient power, so in addition to the compost, he adds vitality to his crops by turning his water supply into a liquid fertilizer. He stocks his water tank with bits of nettle, pine boughs, "seaweed if I go to the coast" — anything that will fortify the broth's potency.

In his spare time, he thins the trees up on the mountain, ministering to the forests and the creeks. "My goal," he says, "is to get the creeks higher, to catch the load of the creek water and spreads it out on the land, not let it just run off down the hill." So he plugs creeks with rocks and branches and is proud of the renewal of the willow and red alder populations fillings in the bank.

For those interested in the healing balance of the planet, the bottom line about what Cannard does is culinary quality. "The chefs don't really care so much about flavor," he scoffs with bravado. "The chefs want it to be easy. They want to be able to take it out of the box and plop it down on the counter and cook with it. But Alice cares about the flavor." Flavor that's alive.

"It's not me, it's the plants," he says.

There is no single part to this labor. On his land, Cannard has connected the dots among the crops, native plants, trees, rocks, creeks, birds, bees, and wild boars. It is all necessary to what he does: "I grow food." RE

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PHOTO: VERN MODELAND

Tom and Paula Spereano work on annual clean-up in the greenhouse of the S&S Aqua Farm.

A Food Production Revolution

Missouri aquafarmers discover huge benefits in trace elements integrated with hydroponics

BY DAVID YARROW

In the heart of the beautiful Ozarks, a quiet revolution in biotechnology is incubating. The site is a family farm near West Plains, Missouri — the S&S Aqua Farm. Over the past decade, Tom and Paula Spereano have developed a unique, innovative, low-cost food growing system in their solar greenhouse.

The S&S Aqua Farm brochure allures with idyllic imagery: "Imagine gardening year-round with no weeds to pull, no bending to plant or harvest, no worries about watering or weather. Picture you in mid-winter working in a green, vital, healthy environment — doing what you love to do."

Tom and Paula's growing system is called Bioponics — from Greek "bios," meaning "life, or mode of life." Their hybrid system integrates aquaculture and hydroponics in a simple method to produce premium fish, fresh vegetables, herbs, and other plants. This is no mere hobby, theory or novelty, but a steady, reliable, no nonsense source of family food and income.

They explain, "You feed the fish; the fish feed the plants. Plants help the fish by filtering fish wastes from the water. You harvest the vegetables and fish. The more natural we make it, the better it works."

In their closed cycle, self balancing system, mineral-salt plant food is replaced by natural nutrients from a biological source: fish effluent. This practical, ingenious system needs no expensive equipment or patented parts, and uses easily available materials to grow safe, chemical-free,superior quality food. It is adaptable enough to provide family food supply, or expand to commercial scale.

Aquaculture

The heart of Bioponics is the fish tank. Tom uses standard polyurethane hatchery tanks available from PolyTank Inc. The tanks can be purchased in a vast variety of sizes to comfortably house any number of fish or fit any space.

Tom's tanks are stocked with Tilapia, the world's most popular fish for aquaculture, a hardy, disease resistant, warm-water fish native to Africa and the Middle East, and once raised for food by ancient Egyptians. They're delicious, with white flesh and few bones. Most importantly, Tilapia tolerate low oxygen and poor water conditions that will kill most fish.

Tilapia are vegetation eaters. In addition to their regular feed, they devour algae. They feast happily on any excess plant cuttings tossed in the tank. Cuttings are broken down by bacteria into algae, then fish filter the algae out. Their gill rakers can take out anything over three microns, the size of a red blood cell.

"This helps keep water really clear," explained Tom. "With our system, we never

have cloudy water. You can see a dime on our tank bottoms. When we harvest beds, we rake the gravel. Any algae drains into the water, and fish filter that out too; so they get everything back. Extremely simple, but very efficient."

In a production system, maximum growth is achieved by assuring high protein intake, so Tom's fish are fed a daily ration. He detailed what he feeds the fish.

"5106 Purina 40 percent protein Trout Chow," Tom explained, "the most chemical-free I can find. It doesn't have copper sulfate, tetracycline, actinomyecin, and additives, the way many commercial fish foods do. I had no idea the quantity and number of antibiotics and chemicals were so high. A label reads like a chemistry set index."

The feed conversion rate for Tilapia is excellent: a pound of feed yields a pound of fish.

Tilapia grow fast — they reach one pound in 9-18 months and provide firm, white boneless fillets (40 percent by weight), readily marketable at 3/4 pound. Tom sells fish over one pound live weight — generally 1.5 pounds. The fish are harvested regularly by size using nets that catch only the larger fish.

Animals excrete wastes. Since fish dump excess nitrogen (urea, nitrite, ammonia) and other wastes into water, crowding fish together in a closed container, and feeding them high protein diet to force rapid growth, generates a lot of waste. If these fish metabolites aren't removed from the water, they will quickly build up and poison the fish.

Toxic waste — a key limiting factor in aquaculture — restricts a system's production capacity. So fish farmers invest a lot of money, time and technology in waste disposal problems. Pumps, filters aerators, sedimentation tanks, and more equipment clutter and confound most fish farms.

In Bioponics, fish wastes become plant food, and expensive machinery and complex technology are replaced by biology. Plants grown in beds use nutrients in fish water, and purify the water to benefit the fish. A Bioponic system is simple and revolutionary for the very reason that it doesn't use the technology normally necessary for aquaculture and hydroponics.

Hydroponics

Plants grow in permanent beds which contain pea gravel as growing media. Periodically, pumps flush these beds with water from a fish tank. Plants get all the nutrients they need from this irrigation water with no cost or fuss to mix chemicals. Thus, animal wastes become plant food, and Bioponics removes the need to add fertilizers to the feed plants.

Beds can be any size or construction, from wood-frame home built boxes to standard commercial polyurethane containers. S&S Aqua Farm has 2400 square feet under solar greenhouses. The growing system is segmented into "nodes", where a node is one fish tank with six growing beds. The grow beds are under glazing and the fish tanks under standard roof. This allows the black fish tanks to receive sun through the winter, but are shaded in the summer.

Fish water — effluent — is pumped from a tank through 1-inch PVC pipe straight to growing beds to trickle through their length, then pumped back to the tank. Effluent isn't filtered or purified before reaching growing beds. Water is aerated as it flows out holes in the pipe and trickles over gravel.

"It's been suggested if I use the right size apertures, I can increase the aeration of the water" Tom revealed. "But my dissolved oxygen levels are high enough right now — 6.5 or so — that I've got all the dissolved oxygen I need."

In the stable, moist greenhouse atmosphere, plants grow in denser spacings than conventional garden beds. Tom's beds are so nutrient-rich and fertile, plants grow in less time than by conventional methods — and larger, too. Tomatoes are tied up in tall vines, and peppers become baby bushes. And cuttings from almost any plant (even trees) will root and grow if stuck in a bed, with no rooting hormones or chemicals.

In return for fish effluent feedings, the plants — through their roots — purify and recharge the water for fish. As a bonus, when a bed is harvested, the gravel is raked, and any algae washes into the tank of hungry tilapia.

"Experience with hydroponics," explained Tom, "was there's always a toxic residue left: salts. Modern commercial farming faces this same toxic dilemma: the residue from fertilizer is salt."

Conventional hydroponics purify water

The Spereano's home and farm stretch out beyond the glass walls of the greenhouse. Inside those walls, New Guinea Impatiens and three beds of basil from transplant survive.

with expensive feeder lines and emitters. Bioponic growing beds are themselves fluidized bioreactors — very efficient biofilters that purify water by biological methods and commonplace materials, without separators and clarifiers to remove solids.

The Bioponic approach to system integration not only knocks out nitrogen troubles, but carbon dioxide, too. Plants need CO2 to grow. In winter, this scarce gas is a growth limiting resource.

"Everybody said, 'put in CO2 generators.' But I've got tanks full of CO2 generators. They're alive and have fins. Fish are CO2 generators for the system — something I didn't foresee, just a natural side effect. That's a lot simpler than hydroponics."

Indoor Farming

Over nearly a decade, Tom and Paula have experimented with growing many different plants — ornamentals, herbs and vegetables — from seed, seedlings and cuttings. Most attempts were successful. They've grown food crops, fresh-cut herbs, house plants, and rooted cuttings. They also supply starts for flowering basket sales.

"We've grow over 450 different varieties, 12 months a year in a commercial production system," Tom revealed. "Lots of leaf lettuces and salad greens, three types of eggplant, over a dozen tomato varieties and more than 20 herbs. And peppers, sweet and hot, over 41 different varieties." Tom slowly detailed each variety with the familiar ease of a veteran tour guide and salesman.

"We also grow over 20 flowering and ornamental plants," he went on, "plus potted plants, hanging baskets and cut flowers. In spring, we have all the normal garden starts: peppers, tomatoes, cukes, brassicas. And herb planters."

Additionally, they produce value-added specialty products. "Currently," Tom said, "we bottle about nine peppers as hot sauces under the 'Ozark Originals' label. And $6 per pound for lettuce mix when people won't pay $2 per pound in the store. Keeps for a week, but store stuff won't, even if refrigerated."

S&S Aqua Farm wholesales to two local restaurants that pay premiums for the farm's fresh, flavorful produce, salad mix, hot sauces, and fish. They retail to subscribers as well, and sell excess at a local farmers market, of which Paula is currently president. Also, one gets the impression Tom sells a good amount to a steady stream of visitors who come to see this food growing revolution.

Plant roots only take up nutrients after the microbes consume and convert them. It is these teeming tiny creatures that filter, convert fish wastes to plant food, and recharge the water.

To sustain this self-contained, Polycarbonate enclosed, mini-ecosystem of plants and animals in healthy balance and productivity, many complex, synergistic interactions cooperate in its low tech setting. The past nine years of experience at growing fish and vegetables and his study of scientific literature taught Tom that plants alone do not purify the water for fish. His closed cycle system has a third, invisible, living component: bacteria.

Hidden Resources

"I've raised fish for 43 years — since I was seven. We understood from the very beginning that bacteria are vital to fish health by reducing ammonia and nitrites," Tom said. "With a microscope and staining technique, you can see these microbes. Otherwise, they're too small and transparent to be visible."

Unseen, unseeable, a few pounds of micro-organisms thrive on gravel in the beds. Plant roots only take up nutrients after the microbes consume and convert them. It is these teeming tiny creatures that filter, convert fish wastes to plant food, and recharge the water.

"We have fairly high pH," Tom explained, "so nutrients can't cross the pH barrier. Extension Service said add sulfuric acid or cider vinegar to reduce pH to 5.4. It took me three years to figure out why it works, when it shouldn't — that bacteria carry nutrients against the pH barrier. That insight came from several magazine articles and a book from Britain."

"A growing bed isn't just a gravel-filled trench, but a 'fluidized bed bioreactor' — a living biofilter," Tom enthused. "In any mechanical filtration system, this key component must be back flushed to get solid wastes out. But with Bioponics, bacteria dissolve solid wastes, so we don't have any buildup."

In soil, legumes (bean, pea, vetch, clover), in their root nodules, work symbiotically to form plant food The plant food (nitrate, NO3) serves to synthesize amino acids; it is formed when the soil microbe, rhizobia, that specializes in the trace element molybendum, to fix the two most abundant gases. This mineral-to-microbe-to-plant nitrogen-fixing food chain is a foundation to all agriculture.

Similarly, in Bioponics, microbial links turn animal wastes (nitrogen) into plant food (nitrates).

But we really know little else about this unseen universe, and the myriad lifeforms of this microbial dimension. Who are these bacteria? What is their active biomass? How do they digest minerals into streaming liquid protoplasm? How do they digest and disarm toxins? How do they make nutrients available to plants? What other specialized functions do these microbes perform? What do they require to thrive?

Population and Culture

In a system point of view, there are three essential components to a Bioponic operation: fish, plants and bacteria. A healthy population of bacteria is a necessity, and limits how many fish can be maintained. Without them, fish will die in their own toxins, and plants will starve. Hardware can't replace the indispensable biological component, it is used only to optimize the lifecycles of the three main elements.

"Our bacterial inoculants came from my older fish tanks, which has at least 28 different organisms, Tom explained, "where commercial preparations have three. We had our bacteria checked for pathogenic bacteria. There are none.

If other people start a new system, we send them a bottle of bacteria from our beds to jump-start their colony."

As a critical element in the system, bacteria must be treated with care and respect. What do bacteria need? Warmth, moisture, dark, oxygen, minerals — all present in a Bioponic system under the surface of the growing beds.

"The bacteria aren't particularly fragile. They survive temperature changes and water fluctuations quite well. But the productivity of the whole system is gaited by the health and growth rate of your bacteria," Tom insisted. Always assure good oxygen supply: life needs this gas. Bioponics prescribes methods to aerate fish water. Cultivation of growing beds when empty provides more dissolved oxygen for fish, and increased oxygen for bacteria and plant roots.

Tom's novel success is intimately linked to his care for bacterial life. Even farming and forestry, until recently, gave scant appreciation or analysis to the presence and purpose of microbes in soil health and fertility. Rather, soil organisms were routinely drenched with toxic chemicals.

Natural and Non-toxic

One serious threat to these Bioponic microbes are antibiotics. Tom remembered, "We were given 200 pounds of commercial catfish feed. I fed it to our test system in the small greenhouse. Within three days, I had fish deaths. Ammonia and nitrites went off the scale. It was medicated feed, and killed the bacteria. It took the system about ten days to recover."

S&S Aqua Farm has a philosophy to guide its quest for improved biotechnology. Eating food from this closed cycle, greenhouse ecosystem, and selling it to friends and neighbors engenders a deeper responsibility for quality and purity. Tom and Paula wrote:

"We believe in growing as naturally as possible, but our system demands it. Any pesticides sprayed on plants will find their way into the fish. Any antibiotics poured in fish tanks to treat disease will find their way to plants and kill bacteria.

"Synergistic relationships of plants, fish and microbes necessitate no chemical pesticides or medication. Predatory wasps, ladybugs, lacewings, Bt and other specific organically approved methods are used to control whiteflies, aphids, and other pests and diseases of plants. In addition, the system is environmentally friendly. There is no effluent, no runoff, no mixing fertilizers.

"Having a safe, consistent source for food is a constant concern for many people. We believe that is why we receive so many inquiries. We were truly amazed at the response until we examined our own motivation to develop the system." For Tom and Paula, this environmentally friendly system is about more than just responsibility, it's about growing food in an efficient way that makes sense.

Recirculation, and efficient reuse of water means only seven percent per month must be replaced due to evaporation and plant uptake. Minimal electricity is used because the solar greenhouse maximizes use of sunlight and doesn't need heat. Fish tanks are black to absorb and retain heat, and water's high specific heat moderates temperature shifts. Warm water, high nutrient levels, CO2 from fish, and frequent flow allow growth all winter.

The system is flexible. A "node" — a tank of fish and connected beds — can be small enough to fit in a kitchen. Or one or more nodes can fill a backyard greenhouse. Or a number of large nodes can function in a commercial greenhouse.

Tom's water world of well balanced animals,

Each fish tank is coupled with six growing beds to create a nearly self-sufficient node! This is an east to west view, with the tanks on the north side of the greenhouse.

plants and microbes is a stable ecosystem that continually produces an abundance of food, herbs, flowers, and income. This smooth running, closed-cycle, self-sustaining system in a greenhouse is very sensitive — an ideal laboratory to study biological effects of minute proportions.

Such as trace elements. This carefully controlled, steadily monitored system is an ideal environment to test the effects of the least of all the elements. That is what Tom did in 1997. The results surprised him.

Testing Trace Elements

A friend of Tom's read about Planters 2 — a trace element, rock dust fertilizer mined in Salida, Colorado — growing superior crops, and suggested contacting U.S. Soils, the manufacturer. For Tom's first test of rockdust in his system, he was sent 20 pounds.

"Planters 2 is supposed to be micronutrients and substances that are essential, but not necessarily available, in common soil," Tom recalled.

"Like chromium. 99 percent of the people in the U.S. are low in chromium. We're chronically deficient in our diet, and don't have a lot in soil."

"Yes," I agreed. "I just read that in a list of facts from the American Diabetes Association."

"For health purposes, I take trace nutrients myself," Tom continued. "We use liquefied seaweed extract in our fish tanks quarterly, in case there's any missing trace elements or nutrients. Planters 2 seemed to be a good mineral supplement, so adding trace mineral elements seemed a logical extension of what we do.

"It just made good common sense," Tom admitted. "From all the literature, I expected an increase in growth, and yield. In plants and fish. So we tried it, and measured the effects. We tried to establish how much better growth was with Planters."

Beginning early in 1997, once a month Tom sprinkled four ounces of Planters 2 — about a quarter cup — into gravel beds in two of his four nodes. Periodic flushes with fish water washed it in, and bacteria in the beds took it up and fed it to the plants. This very small amount — hardly a handful — is really quite generous, since this is trace element fertilizer. The amount of chromium, cobalt, copper, selenium, vanadium, and iodine needed will fit in a thimble. Tom's system is completely closed and self contained, so any added substance stays in circulation. None is lost to leaching beyond reach of roots — unless it's harvested in the form of plants.

"Plants [grown with rock powders] are more robust," Tom said. "Better color. More resistant to fungus, blights, mildews, and rusts. Tomatoes flower earlier and better. We noticed, too, that plants mature faster."

Precise production records in seven months of 1997 revealed 21 percent and 24 percent increases from the beds fed Planters. Before becoming a Missouri aquafarmer, Tom was a top research engineer in lasers and computer systems for Bridge Communications at Southwest Bell. His meticulous records and calculations neither lie nor exaggerate: lettuces, tomatoes and peppers all produced significantly more in both beds fed trace element fertilizer.

Like everyone who tries rock powders, Tom sees more than bigger produce. "Plants are more robust," Tom said. "Better color. More resistant to fungus, blights, mildews, and rusts. Tomatoes flower earlier and better. We noticed, too, that plants mature faster." Tom said slowly, thinking carefully, choosing each word.

An added benefit is better flavor and keeping quality — a premium to restaurant customers. Earlier flowers improves overall efficiency, productivity and profitability.

"We are feeding the rockdust to bacteria, not directly to plants," Tom added. "Same thing we do with wastes from the fish — ammonia and nitrites — feed it to the bacteria, who do conversion for plant uptake." Tom has no data yet of effects on fish, but early indications are more rapid weight gain and better survival. His educated intuition suspects his fish, too, are healthier — and tastier. I pointed out this gray Colorado rockdust has been used to good effect as livestock and poultry feed.

Tom is so convinced by seven months of data, visible signs of greater system stability and vitality, and the simple sense of it, he is feeding Planters to his other two nodes. He appreciates Planters' reputation, with a 50-year history of safe, successful use in agriculture as plant food and livestock feed supplement.

Geology–Biology–Ecology

Tom explained what he believes Planters provides.

"Rockdust is a composite of glacial materials, or ancient sea bed materials," Tom offered, "that contain all the micronutrients, trace elements or nutrients that may or not be available."

Planters come from a unique geological deposit that eludes classification. This odd deposit is of uncertain, controversial origin, and may be sediments of ancient mineral springs, which means its minerals were dissolved in and charged by moving water. As a mineral, it is called "Gypsiferous shale."

Planters, whatever its geological identity, has a high solubility compared to other rockdusts. In Tom's Bioponics system, this is a decided advantage and desirable characteristic. Tom discussed the possibility of supplementing with other materials.

"I read up on powdered granite," he replied. "You could put powdered granite in there, but I don't see what it would yield. I stay away from clays because they float on the water surface, and I'm not sure it will do the tilapia good to filter that out."

S&S Aqua Farm believes their Bioponic approach to integrated food production is practical and worth emulating. At a time

when "biotechnology" has come to mean DNA splicing, gene engineering and cloning big corporate labs — all "hot button" controversies — Tom and Paula have redefined this word as safe, sensible, human scale, sustainable, and user-friendly. However, theirs is no turnkey system, or prepackaged, get-rich-quick scheme. It calls for a modest investment in equipment and a great deal of skill and knowledge are requisite.

To minimize "trial and error," and allow anyone to quickly start a successful system, Tom and Paula put what they learned in an information package to specify how to set up a system, whether for family food, or profitable business. RE

Other articles about S&S Aqua Farm:

- *Small Farm Today,* June 1992.
- *Back Home,* Summer 1993.
- *Missouri Conservationist,* August 1993.
- *The Growing Edge,* John Smith, Vol 5 No 2, Winter 1993-4.

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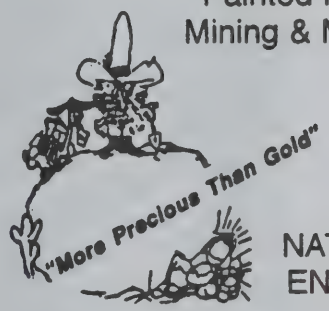

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Byproduct Utilization in Agriculture

Past experiences and potentials for the future

BY RON F. KORCAK
a research leader with the U.S. Department of Agriculture, Agricultural Research Service Fruit Laboratory
reprinted from *Mining Engineering*, August, 1996, p. 79-82.

Abstract

There exists a wide array of industrial byproducts that produce beneficial responses in the soil/plant environment. These materials range from clean-coal-technology residues produced during the generation of electric power (particularly those high in gypsum) to mineral fines produced by the aggregates industry (i.e. sand, gravel and crushed stone). A number of these materials are examined in relation to potential nutritional interactions in soils and crops with emphasis on trace elements. The significance of utilizing these materials in agriculture as a component of sustainable agricultural systems are discussed

Dr. Ron Korcak and Bob Able inspect leaf quality on the USDA study's trial corn in Beltsville, Maryland.

Introduction

We are increasingly being faced with the dilemma that, for obvious logistical and economic reasons, goods are produced in concentrated areas and, as a result, the byproducts are disposed of in confined locations. Good examples of this are poultry and crushed-stone operations, which produce poultry litter and mineral fines. In the case of poultry litter, the potential for nitrogen and phosphorous pollution increases, and, in the case of mineral fines, limitations in storage and the need for additional permitted land become problems.

The agricultural environment has been a receptacle for a number of byproducts. The utilization of industrial byproducts in agriculture is not new. However, past utilization practices have usually centered around the application of a solitary byproduct.

A period of renewed interest in utilization is now foreseen. This requires a re-examination of the role and usefulness of industrial byproducts in agriculture.

A new paradigm is necessitated because of the following;

- the urban-rural boundary is less well defined in certain locales;
- policies and practices of the past are being re-evaluated and are held under the scrutiny of the lay public,
- economics have changed and may actually favor utilization vs. stockpiling and landfilling;
- there is a growing awareness of the need for sustainability, not only in agriculture but in society at large; and
- a broader range of knowledge is now available that can be applied to the environmentally sound utilization of these materials.

Newer concepts, such as "designer wastes" or co-utilization of byproducts, are now being explored and, to a limited extent, implemented. Blending (mixing) of two or

more byproducts to solve a problem or to meet a particular need is the goal of the "designer-waste" concept. For any given byproduct, the use of chemical composition data may act as a first level discriminatory tool to identify those byproducts that have potential as "designer wastes." This discriminatory evaluation will, in most cases, center on trace elements. Therefore, the role of trace elements in plant and, to some extent, animal and human nutrition, and how this information translates to utilization of industrial byproducts in "designer wastes" or as components of co-utilization systems needs to be reviewed.

Essential and nonessential elements

Sixteen elements are considered to be essential for the growth of higher plants. These include those required in relatively large amounts (1 percent dry weight or more), i.e., H, O, N, C, K, Ca, Mg, P, S and Cl, and those required in relatively small amounts (ppm levels), i.e., Mn, Zn, Cu, Fe, B and Mo. Except for foliar sprays or deposition from the atmosphere, these nutrient needs are normally met by the soil.

The information on trace elements that follows is by no means complete; but the information is presented to provide some ideas on the effects and interactions between trace elements that need to be taken into account prior to the utilization of any byproduct. Although variable, the trace-elements in soils usually falls within the values listed in Table 1. These soil trace-element ranges are compared to a sample of igneous rock fines that was obtained from the crushed stone and aggregates industry.

The soil ranges shown in Table 1 for the essential plant nutrients Zn, Cu, B and Mo may provide an initial basis for evaluating potential byproduct utilization. As expected, igneous rock fines fall within the recorded soil ranges, and one could recommend land application of these fines.

However, plants are susceptible to phytotoxicitics from both excesses of essential nutrients and accumulation on nonessential nutrients such as Se, As, Cd, Cr and V.

Trace element variation in soils and igneous rock fines (Source: Baker and Chesnin, 1975), in ppm.

Element	Soil	Igneous rock fines
Zinc	10–300	80
Copper	2–100	70
Boron	2–100	13
Molybdenum	0.2–5	1.7
Selenium	0.1–2	0.09
Arsenic	1–50	2.5
Cadmium	<0.1–0.7	0.13
Chromium	5–1000	117
Vanadium	20–500	90
Mercury	<0.1–0.3	0.06
Lead	2–100	16

Table 1

Therefore, any first-order discrimination of byproducts has to include both nonessential and essential elements. This complication can be dealt with by considering how the nonessential elements compare to the normal ranges found in soils. A body of knowledge exists on the behavior of nonessential elements in plants, particularly those that can become phytotoxic and/ or elevated in the food chain.

Phytotoxicity and the food chain

There are a number of trace elements, either essential or nonessential, that are of concern from a phytotoxic or food-chain viewpoint. This concern arises not only from actual amounts of any particular element but also from the interactions that occur between elements.

- **Cadmium.** In recent years, Cd has been of interest because of its bioaccumulation in the food chain. The question is, How much Cd can be land applied without undue harm to the food chain? As a general rule, Cd should be c 1.5 percent of the Zn content in any material to be land applied. The premise for this relationship is that plant growth would suffer from Zn phytoxicity before elevated levels of Cd could accumulate in the plant.
- **Mercury and lead.** Care not only has to be taken with Cd but also for Hg and Pb. Together, these three metals should be minimized in food plants—not because of phytoxicity, but to reduce food-chain bioaccumulation.
- **Molybdenum, vanadium and selenium.** Molybdenum is an essential element for both plants and animals, while Se is known to be essential for animals but not plants. Vanadium has been shown to be essential for algae and may be essential in the mineralization of bones. These three elements are of concern, because their optimal concentration range in animals is narrow. Thus, any substantial increase in plants may result in imbalances or toxicities in animals.
- **Nickel, cobalt and chromium.** Both Ni and Co are essential to plants; but in very low concentrations. Cobalt and chromium are both essential to animals, while the essentiality of Ni has not been demonstrated. Nickel and Co uptake in plants can be decreased by liming. The availability of Cr is generally low in soils at all pH levels.
- **Arsenic.** Arsenic is not essential to either plants or animals. Arsenic in the oxidized form (arsenate), may be bound by the clay fraction or iron oxides in soils (Adriano, 1986). There also exists a strong soil/plant AsP interaction. Added phosphate interferes with As uptake at the plant root. Phosphate may also aid in moving As downward in the soil profile.

Information such as that given above needs to be taken into consideration when making decisions on the potential utilization of an industrial byproduct. Some examples of utilization experiments that highlight the utilization of research information in the decision making process are presented below:

Industrial-byproduct utilization

- **Case 1:** Mineral fines. A number of industrial byproducts are being examined in demonstration plots at the USDA/ARS Beltsville Agricultural Research Center in Beltsville, MD. These are nonreplicated plots that were established to identify byproducts to be used in expanded experiments in the future.

The crushed-stone and the sand and grav-

el-aggregates industries produce byproduct fine materials that may be suitable as a soil amendment. These materials are low valued in terms of conventional synthetic fertilizers and are usually relegated to stockpiles or settling ponds. Three different material sources are under study: granitic stone fines from Georgia, glacial outwash sand and gravel fines from New York and metabasalt stone fines from Maryland.

Ready-mixed concrete trucks are usually rinsed upon return to the batch plant. These washings may be classified (screened) to remove and recycle fine and coarse aggregate with the effluent (which contains hydrating Portland cement and aggregate fines) ponded and dewatered. The semidry effluent is being used as a soil amendment because of its high Ca content and acid neutralizing properties.

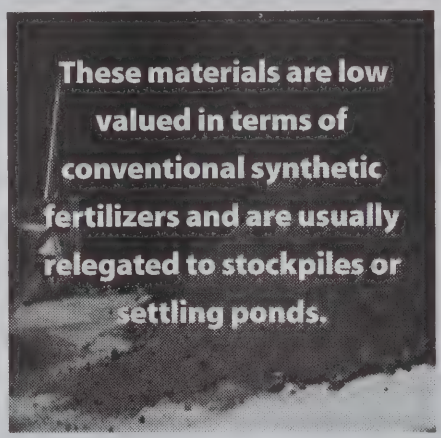
Conventional coal burning for electric-power generation produces two primary byproducts fly ash and bottom ash. The granular bottom ash from a conventional power facility is being examined as a nutrient source and for its acid-neutralizing power.

Test plots that were not replicated measured 7 by 24 m. Each plot received one of the aforementioned byproducts over the entire area. The application rates were 22.4, 19.7, 22.4, 14.3 and 20.4 t per hectare (dry weight basis) for Georgia granitic stone fines, New York glacial outwash gravel fines, Maryland metabasalt stone fines, cement washings and bottom ash, respectively. Selected elemental compositions of the applied materials are shown in Table 2.

Each treated plot area was divided in half with one half receiving the equivalent of 150 wet t per hectare (63 dry t per hectare) of composted yard waste (Source: LeafGro from Prince George's County, Maryland) containing 1.2 percent N. An additional plot received composted yard waste, both with and without synthetic fertilizer, applied at 70 percent of corn crop needs, as estimated from soil analysis. A control (non-amended) plot was also included.

After a spring application of all materials, corn (*Zea mays*) was grown during the summer of 1994. During July, diagnostic ear leaf tissue samples were obtained and analyzed for chemical composition. Some of the ear leaf tissue analytical data are presented in Table 3.

The data present some interesting trends, even after a short residence time of the applied materials in the soil. However, it should be cautioned that these trends are from nonreplicated demonstration plots; therefore, one should not assign any statistical significance to these trends. The metabasalt fines used in this comparison contained 300 and 200 ppm Cr and Ni, respectively, compared to the outwash fines, which contained 38 and 49 ppm Cr and Ni, respectively (Table 2). Correspondingly, this difference in material composition was reflected in the ear leaf tissue (Table 3). However, the addition of synthetic fertilizer with composted yard waste resulted in higher Cr and Ni tissue concentrations than the metabasalt.


These materials are low valued in terms of conventional synthetic fertilizers and are usually relegated to stockpiles or settling ponds.

The sources of mineral fines used in this study all contained low levels of Cd. Ear leaf Cd was very low with each or all of the fines, both with and without composted yard waste. However, composted yard waste, both with and without fertilizer, and the control-plot plants contained higher tissue Cd concentrations. The exact reason for the elevated Cd levels is unclear at this point.

All treatments tended to elevate tissue Zn concentrations compared to the control plots. This is an indication that mineral fines and the organic compost may be a source of Zn, an essential trace element. This occurred even though the concentration of Zn in the different sources varied greatly (Table 2).

Independent of mineral-fine source, composted yard waste increased the concentration of the essential macro-nutrient K. However, depending upon the mineral-fine source, the tissue K tended to follow the initial material K content of the applied material in the absence of composted yard waste. The granitic material was relatively high in K (Table 3), and this was reflected in the relatively high K status of ear leaf tissue when granitic fines alone were applied.

There are a number of variables not included in the above discussion that could have significant effects on their reaction in the soil/plant environment. These include pH, particle size distribution, weatherability and freshness.

Case 2: Clean-coal-technology byproducts. There are a number of technologies now being employed by the electric power industry to reduce gaseous emissions during the combustion of coal. One of these technologies is fluidized-bed combustion (FBC), wherein coal is simultaneously combusted with an absorbent (usually limestone). The resultant byproduct is about one-third each of coal residue, gypsum and unreacted sorbent (CaO). This combination of materials makes the byproduct an attractive soil amendment. The unreacted sorbent can substitute for limestone as a soil pH modifier, and the gypsum, owing to its greater solubility compared to limestone, can have a significant impact on many soil chemical and physical properties (Shainberg et al., 1989), and the ash component can be a supplier of essential macro- and micronutrients to plants.

Over the past decade, numerous studies have shown the benefits of utilizing FBC residues in agriculture. The US Department of agriculture (USDA) activities in this area have been published as a manual for application (Stout et al., 1988). New approaches in utilization of FBC residues are now being considered under a joint USOA/ Department of Energy agreement (DOE project No. DE-AI21-94MC31205). FBC residue is currently being field applied in the state of New York as a soil pH modifier/trace-element source for alfalfa fields. Alfalfa usually requires annual

applications of B for good growth. The use of FBG residue fulfills this requirement due to the B contained in the FBC residue. The FBC residue is also being used to stabilize dairy barnyard areas. Applied fresh, the FBC/soil/manure mixture forms a cementlike "pad" that remains porous. The stabilized areas eliminate mud and associated problems to the cows. The new project will investigate trace-element movement through and off the stabilized "pad."

An additional component of the project involves the potential to reduce N and P pollution from manures and the feasibility of scraping the stabilized "pad" (FBC + soil + manure) to use the mixture as an off-site soil amendment. This latter objective incorporates the concept of blending and mixing byproducts to enhance the value of individual materials and, therefore, increase the distance that a blended product can be economically shipped and utilized as a soil amendment.

Case 3: High gypsum byproducts. Gypsum, as noted earlier, is used as a soil amendment to improve infiltration, reclaim high sodium soils, increase rooting in acid subsoils and supply Ca and S to plants. Flue-gas-desulfurization (FGD) technologies in the combustion of coal for electric power generate large quantities of byproduct calcium sulfite and gypsum. Current uses of FGD gypsum in agriculture have recently been reviewed (Ritchey et al., 1994a). Calcium sulfite, which can generate phytotoxic sulfur dioxide gas may still be a usable byproduct if the material is soil incorporated several months prior to seeding (Ritchey et al., 1994b).

Industrial acid-neutralization processes may also generate usable byproduct gypsiferous materials. Offiah and Fanning (1994) determined the liming value of a secondary waste-acid neutralization (SWAN) gypsum from the refining of titanium oxides. The excess aragonite used in the refining provides a suitable soil liming agent. However, the byproduct contains elevated amounts of Cr (770 to 1910 mg kg) and V (about 2000 mg kg). Field studies that examined radish growth in 100 percent SWAN amended with fertilizers or sewage sludge showed only slight, if any, bioavailability of V in the edible radish tissues (Korcak, unpublished data).

Scrap wallboard gypsum from new construction is now receiving attention. This is because problems have been noted where these materials are landfilled (British Columbia Ministry of Environment, 1991) and tipping fees are increasing. Agricultural utilization of pulverized wallboard has been studied as a soil amendment to corn (Burger, 1993) and proposed as a soil amendment to be applied directly around new construction sites (Korcak, unpublished report). However, two issues have been raised in the use of these materials as soil amendments. One is the potentially high level of B in some wallboard products. Because B tends to be mobile in the soil system, this may not be a long-term problem and can probably be overcome. Secondly, the contamination of the paper coating the wallboard by dioxin and furans has been raised as an issue. To date, no known studies have been made on the quantities present and fate of these contaminants from soil applied pulverized wallboard.

Sustainable agricultural systems and industrial byproduct utilization

The list of industrial byproducts that have potential use as amendments for the agricultural environment is lengthy. Those noted here represent a few materials that have been examined as amendments. The utilization of industrial or any byproduct has to be evaluated on the basis of protection of the environment and the food chain as well as economically. Sustainable agricultural systems are aimed at reducing inputs, maintaining productivity and preserving the dynamic biology of the soil. The question then is How can industrial byproducts fit into sustainable agricultural systems?

One mechanism to incorporate industrial byproducts into sustainable systems would be to establish recycling/mixing centers. Many byproducts emanate in urban areas and/or near the urban-rural interface around metropolitan areas. These centers would not merely act as collection sites but rather as a facility where materials would be mixed and blended and/or composted to fulfill a prescribed need—hence the term

Aerial view of the eight non-replicated plots as part of the USDA trials in Beltsville, Maryland.

Elemental content of applied mineral 'fines' materials used in the demonstration plot experiment.

'Fines' source	Cr, ppm	Ni, ppm	Cd, ppm	Zn, ppm	K, %
Cement	11	3.4	2.0	10	<0.1
Granite	28	2.2	<0.2	36	5.0
Outwash gravel	38	29	1.0	210	1.6
Coal ash	<0.1	ND	<0.05	ND	ND
Basalt	300	200	<20	<200	1.0
Yard compost	25	55	0.5	138	0.6

ND = Not Determined

Table 2

"designer wastes."

To some extent, this concept has already become reality in the processing of sewage sludges with alkaline inorganic byproducts to produce an artificial soil. Other types of designer products could incorporate mineral fines to overcome known trace-element deficiencies or to produce potting mixtures for the bedding and containerized plant nursery and landscape industries when blended with composted organic materials.

Another use of blended industrial byproducts and organic composts would be in the bioremediation of metal-contaminated soils. Addition of hydrous iron oxide containing materials to compost can increase its ability to bind with and greatly reduce the bioavailability of Pb and As in contaminated soils such as those around houses where lead-based paints were applied in the past or in soils containing As-based pesticide residues.

Many byproducts will probably still be utilized singularly, e.g., fluidized-bed combustion residue and, perhaps, pulverized wallboard gypsum. However, the concept of blending has the advantage of increasing the value of a number of low-valued inputs to help increase economic return. The additional benefit of being able to utilize blended materials further away from the source is one of the goals of the aforementioned USDA/DOE project.

Summary

The agricultural utilization of byproducts from industry is not new and has probably existed for thousands of years. The need to incorporate what is known about the soil/plant/animal system in environmentally sound utilization is apparent. This brief discussion is intended to show how one factor, trace-element content, can be used to discriminate between usable and nonusable byproducts. Although the answer to this question may not always be readily apparent, there is a need to examine these types of factors. Model systems of blended materials should be evaluated and field tested with industrial cooperators. Barriers to utilization, such as those imposed by potential litigation resulting from cradle-to-grave responsibility, need to be overcome. The most practical way to accomplish this is to apply what we know about the soil/plant system, make a sound analysis of the feasibility of utilization, identify potential end users and then gather the necessary data to show the benefit to be gained. RE

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The Case for Agglomerating Rock Dust and Proving its Efficacy

By Lee Fryer
Chairman Food & Earth Services, Inc.
Beltsville Research Center

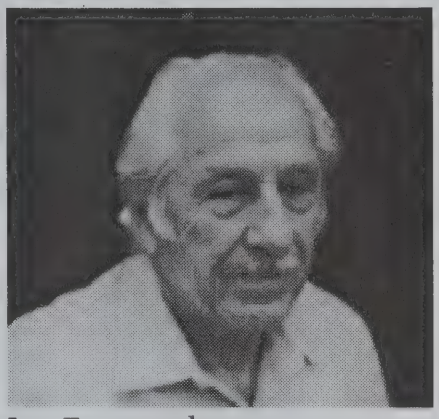
The ancient parable says, "We're between a rock and a hard place". Never could it have been more accurately stated.

The aggregate industry generates approximately 200 million tons of finely ground Rock Dust annually. There are very limited places to put it, as storage areas and settling ponds are filled to capacity. Disposal costs money. Is there really a place in agriculture and pest control markets for these by-products?

For ten months the U.S. Department of Agriculture, Agricultural Research Service (Beltsville, Maryland), has considered this matter in terms of a possibly useful environmental research project, in which the first phase would entail investment of an estimated $150,000 for a series of preliminary greenhouse pot tests. Provided the pot tests indicate real values in view, with investment of another $150,000, plot and field tests will be initiated in 1998 to prove the efficacy of the mineral fines as cost-efficient agricultural fertilizers and pest/disease-control agents.

There is a bit of positive news: other interested companies that may provide agglomerating and mineral chelating agents may share some of these costs, or help to expand and sustain the research services. The questioning follows: "Is this national research program feasible?"; "Will it generate values that can be converted into large-scale sales of mineral fines in the future, with ever-increasing capacity to recycle and dispose of hundreds of thousands of tons of these inherently useful rock materials?"

In this brief monograph I will try to clarify, from a fertilizer and pest-control standpoint, some of the elements and factors that are involved.



Lee Fryer, author

1. What is agglomeration? What values can it generate?

According to the dictionary, agglomeration is "to gather into a ball or mass". In fertilizer industry terms, aggregation is to prill or granulate a product, thereby improving its properties for handling, spreading and application, and generally increasing its potential market value.

However, in the case of Rock Dust, there is also a significant additional value; The agglomerating material, lignin sulphonate, serves as a potent chelating agent, enhancing the nutritional values of the mineral fines. One of the purposes of the Beltsville research program is to validate, with empirical evidence, this potential increase in the commercial and field values of the agglomerated mineral fines products.

2. What is chelation? Why is it vitally important in this situation?

Chelation of mineral elements is a chemical process which, in this case, the Rock Dust fraction is seized and incorporated into an organic molecule which, in turn, can efficiently feed plants and food crops. Thus, chelation improves potential nutritional efficiency of the complex that comprises the mineral fines.

For this reason, agglomeration may be crucially valuable in adapting mineral fines for large-volume sales as special use fertilizers. In addition to adapting Rock Dust for use in up-to-date mainstream farming systems, it can upscale a crop's nutritional values, qualifying for low rates of application, such as 500 to 800 pounds per acre in seed planting and transplanting operations.

One of the objectives of the proposed Beltsville research program is to prove that this chelating effect actually does occur, and further, to measure its efficiency from a soil amendment standpoint.

3. In the agglomeration process, we can also supplement & balance the trace minerals in the Rock Dust products:

It is already known that mineral fines from different regions and stone quarries have different mineral composition. For example, granitic rock is high in silica and related light color minerals. Basaltic rock offers a different mix of potentially useful trace minerals, such as iron, zinc, copper, etc.

One of the Beltsville program's principle aims, from a fertilizer standpoint, is to supplement and provide sufficient amounts of the six (6) trace minerals that are recognized in the "Uniform State Fertilizer Bill" promulgated by the Association of American Plant Food Control Officials (AAPFCO) and state fertilizer laws as being useful or essential to plant growth. These key trace elements are iron (Fe), zinc (Zn), manganese (Mn), copper (Cu), molybdenum (Mo) and boron (B).

If and when desired, supplements of any or all of these minerals can be provided in the agglomeration process in the form of liquid products–such as Multi KE-MIN (manufactured by the Georgia Pacific Company) — or other provisions of chelated trace minerals. (More information on this phase of research and development is available).

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4. Costs of agglomeration, chelation & mineral supplementation:

Reliable cost-estimate information is available since large tonnages of agricultural limestone are currently agglomerated prior to field applications. The following guides are indicated from operations of Mars Minerals, Inc., a lime and mineral processing company located in Pennsylvania:

- Capital cost of a small agglomerator, processing ten (10) to twenty (20) tons per hour–up to 100 tons per day $75,000

Operating and material costs:

- Liquid lignin sulphonate (per ton processed [PTP]) $3
- Drying & moisture control of rock materials (PTP) $3
- Energy input (PTP) $1
- Labor & supervision (PTP) $3

TOTAL $10

NOTE: Cost of chelated mineral supplementation will depend on kinds and amounts provided. They can be included in the lignin sulphonate application.

5. What market niches are in view for mineral fines products?

We foresee these potentially large-scale markets for value-proven Rock Dust products:

- The bulk "non-agglomerated" market, within practical trucking and application radius of interested quarries, as a resource and practice to help restore texture and bio-fertility of soils. This has a promising future, if competently handled and not oversold, to restore fertility and productivity in specialty and high-value crops, such as wine vineyards and herb crops.
- In large-scale composting operations, with or without trace mineral supplementation.
- In enriched agglomerated forms for application with seeding and transplanting in mainstream farming and food crop production as a component in plant disease, nematode and pest controls; and to help restore nutritional and flavor values in food crops (i.e., in cost-efficient organic horticulture).
- As an elite and useful combination fertilizer and neo-organic, pest-control product for home gardens and ornamental plants.

All of these markets may be available if design, production and quality control are adequately developed to address and serve them.

6. The matter of proven disease, nematode and pest control:

For "donkey's years", traditional organic and Rock Dust proponents have alleged that these materials and systems can help provide disease and pest controls. In fact, centuries of field experience and in-situ reports tend to support these claims.

There are premises on which to base these reports. For example, it is believed that relatively complete, balanced mineral nutrition of plants can help them to mobilize their defenses against attacks by insects, nematodes and disease pathogens. Generous use of simplistic NPK fertilizers malnourish plants, blithely omitting comparable supplies of trace and secondary minerals that could be provided in Rock Dust and organic matter.

7. Conclusion:

In the first phase of the proposed Beltsville environmental studies program, we would propose to commence developing technically-sound information; i.e., to prove the efficacy of mineral fines as potential plant disease and pest-control products. In phase two, we would address the matter of effects on yields and nutritional values of food and feed crops.

There is a final crucial need for this research to be initiated and conducted: to provide empirical and systematic support for registry, labeling and sale of the mineral fines products under state fertilizer laws, regulations and policies. We foresee the difficulty, if not impossibility, of developing adequate large-scale markets until and unless technically competent national research data is developed. For the reasons stated above, the call to action is imminent, and the need for standardization of remineralization on an agricultural level is crucial. RE

Cameron and Moira Thomson (right) share time with friends on their farm, Ceanghline.

The Thomson Family and their work in the Scottish Highlands

By Barrie Oldfield
President of Men of the Trees,
Western Australia

On 24 august 1997, Cameron and Moira Thomson held an open day at their new home and garden a few miles from Pitlochry. They and their family of five children had taken up the challenge to establish their new home there only a little over a year earlier. In fact the major work on building up the garden to their exacting standards of buoyant health and sustainability had begun only in April.

Their home is called 'Ceanghline' or "Head of the Glen'. Glen Brerechan is a gentle valley in the Grampians, largely down to pasture with the upper slopes a carpet of heather. Few trees grace the landscape although immediately around their house and at the back of their garden a stand of Scots Pines gives some protection.

Starting in April 1997, they began the stoic work of building a garden on top of the very acid soil of this countryside. All materials were brought in. Municipal compost from Dundee, basalt quarry dust from Tayside Contracting. Two substantial garden beds were prepared. The lower one being a 4:1 mixture of compost and rock dust, the upper bed having an even higher proportion of basalt dust plus about equal parts of the local moraine gravels.

No attempt was made to dig in the imported materials with the existing garden soils. In fact, their intention was to overlay the whole area in order to neutralize the pH and to stifle any weed competition. Beds were built up initially to 60 cm depth. Where the beds tapered out on the rising ground, cardboard was spread first to prevent weeds growing through. Even so they have some problem with thistles which have persisted and come up through two feet (60 cm) of soil.

Overworked and underfunded

The remineralization work of Cameron and Moira Thomson has been known for

many years. They are stalwart advocates of the method. Even so, the profusion of growth in their new garden is an astounding sight and supports everything they have ever said in praise of remineralization.

Scientists from Glasgow University have at least taken interest in their work and a little monitoring has begun. But the progress of support is slow and the need is great. Like everyone else working honestly to restore the ecological balance, to make the environment come truly alive again, the Thomson spend every last resource on what their hearts believe in. The task itself is financially and time costly. It generates no income for them whatsoever. The whole world expects them to give and returns nothing but a salutary comment.

Can we ever find the funding to do the honest things for the earth? While the abuse of the earth still reaps profits for those who exploit it, we must pool the resources from within our community. The Thomsons are seeking funds to continue their important work. The cry goes out to you, the readers of ***Remineralize the Earth***. Please send them a cheque in support of their ambitious project.

New video

Thrilled with the fact that we had at last met, I took the opportunity to record Moira's commentary on how they had built the garden, their theory of rockdust, and their hopes for the future. Cameron also gave a most enlightening walk through the procedures showing the unbelievable yield of potatoes from just one plant, the broad beans, the blue-skinned potatoes and the early potato varieties grown by Incas, the Brussels sprouts, the onions, and the young trees he was propagating.

But the video catches more than the spoken word. There is the luminous quality of Moira's russet hair that speaks volumes for the health they enjoy from eating the fresh produce of their reminrealized garden. There is the spirit of the children, and the kittens, romping through the vegetables without breaking a single stem, and without the usual bellow from Mum or Dad telling them to 'get off there!'

The final word went to Dr. Walter Yellowlees, a founding member and former president of the McCarrison Society. McCarrison's work in Public Health in India many years ago had taken him into Hunza Country in the Himalayas. Here he studied the snow melt and the cascading rivers that brought down an annual dressing of rock dust to help fertilize the terraces. And here he developed his observations on the interdependence of a healthy soil, healthy food and healthy people.

The video is called *The Flourishing* (21 minutes long), and is available on VHS cassette. Cost is AUS $35, plus $10 postage from Barrie Oldfield, 3 Over Avenue, Lesmurdie, Western Australia 6076. Support the Thomsons through contributions send to *Remineralize the Earth*. RE

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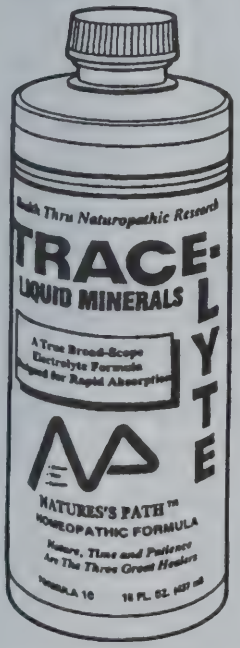

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— John Hamaker
The Survival of Civilization

By Peter Bogdanov

Proponents of Soil-Remineralization (SR) have identified a sine qua non, an indispensable element of soil fertility, without which, according to SR prophets Hamaker and Weaver, our very survival stands in peril. Yet, as biological life is dependent upon the soil, it becomes essential to view the entire matrix of living things and their substrates holistically. While we do well to focus upon the missing components of soil fertility, the magnification of our lens must be adjusted to a larger picture. In short, the presence or absence of one component affects the vitality of the whole, but it is the whole with which we must be concerned.

Traditional soil chemical analysis provides an incomplete picture without information about the soil organisms that make up the complete soil foodweb.

One example of the attempt to look more broadly at the dynamics of soil ecology comes from Oregon. Information concerning the synergy of both soil biota and soil chemistry is just now being made available by a new wave of commercial laboratories. Soil ecologists at Oregon State University (OSU) have developed methods of assessing the living, dynamic system of the soil foodweb. Realizing that there is more to soil health than traditional chemical analysis of N-P-K, these researchers also measure beneficial soil organisms that make nutrients available to plants, reduce disease, reduce nutrient losses and help degrade toxic compounds. Traditional soil chemical analysis, they say, provides an incomplete picture without information about the soil organisms that make up the complete soil foodweb. In January of this year, Dr. Elaine Ingham of OSU presented a two-day workshop geared for commercial composting operations, explaining the significance of bacterial and fungal-dominated soils in agricultural, forest, and landscape environments. Dr. Ingham and James Barlow have established Soil Foodweb, Inc., calling it the first commercial lab to offer a window into the plant-soil relationship.

Efforts like these to join university scientists, compost-makers, and farmers must be applauded. But there are additional links beyond those connecting soil fertility to plant vitality. Human nutrition also comes into play.

Nearly twenty years ago, I wrote training manuals and brochures for a company marketing organic foods and "natural" food supplements. Then, as now, it was understood that we could not depend upon large-scale purveyors of foodstuffs to deliver optimal

& Recycling

nutritional content. When a consistent supply of organically-grown produce was not available, natural food supplements, we suggested, would help make up for the deficiency. We supported the then nascent organic foods movement, realizing that soil fertility held the key to our enjoyment of "healthy" food, and hence, a healthier life. But we felt absolutely dwarfed by the prospect of re-training American farmers to withhold the application of pesticides and herbicides to their crops. The now $3.5 billion a year (and growing) organic foods industry shows not only how far we have come, but since it still represents a tiny fraction of the entire agriculture industry, shows how far we have yet to go.

Why do people take food supplements? Because of a perceived dietary deficiency. While food processing techniques contribute to nutrient loss, many foods are nutrient-deficient at the point of harvest. The soil fertility-plant vitality-human nutrition connection is readily apparent to many. And that is why millions of people consume vitamin and mineral food supplements.

But what is significant about much of our knowledge is the tendency of so many to isolate one factor and hail it as the "missing link." To the extent we limit our focus to one area of importance, we run the risk of wearing blinders, missing out on the importance of sustaining the complexity of our eco-system I want to illustrate some aspects of our ecological myopia by looking at the organics recovery industry where a broader view by some might be taken.

As Director of VermiCo, a vermiculture business in southern Oregon, I have been able to interview a number of individuals in the worm-growing and vermicomposting industry, publishing these interviews in our newsletter, Casting Call. We also track the composting industry and report on issues concerning soil fertility. The newsletter has become one way for us to apply the concept of "putting it all together."

When beginning my investigations on vermiculture, I was struck by the differences in the first two systems I visited in Southern California. One worm grower used dairy manure as a feedstock and, while realizing the value of worm castings as a soil amendment (he proudly displayed gigantic radishes and tomatoes as evidence of the powerful effect of worm castings), he nevertheless sold worms (and not castings) as his primary business. But he shared a vision with a local dairy farmer just down the road who was paying thousands of dollars per year to remove manure. Redworms, he told the dairyman, could convert his manure into castings, a marketable product. Worms could turn his debit into a credit. At this point vermiculture (emphasizing the breeding of earthworms for re-sale), shifts to vermicomposting (which emphasizes organic waste conversion by earthworms into vermicompost, i.e., worm castings, the chief end-product). On the same day, I visited a 60-acre landfill diversion site, where the organic fraction of municipal solid waste (MSW) was being applied to hundreds of outdoor wind-rows filled with composting worms. Even though these rows were glistening in the sun from the tiny shards of glass which are impossible to remove from incoming MSW, the resultant vermicompost could be screened and sold for agricultural use. "The loop is closed," I thought. Vermiconversion of municipal organic waste can provide a high-grade soil amendment to enhance soil fertility. Earthworms can be used successfully in waste management.

Organic matter content is simply one of the ingredients of a healthy soil. As I attended compost workshops and became a certified compost facility operator, I learned about the process of microbial decomposition of

Residuals to Fix Heavy Metals in Soil

By Robert C. Penn, Jr.

A 1994 study showed promising results in reducing health threats from lead-contaminated soil. In this study conducted at Louisiana State University and Xavier University with cooperation from the U.S. Environmental Protection Agency and the U.S. Dept. of Agriculture, researchers combined organic products with lead-contaminated soil and added it to the diet of laboratory rats. N-Viro soil, a blend of organic biosolids and alkaline mineral dusts, was the most successful product in reducing lead concentration. Some lead remained in the soil but, "researchers believe a complex set of biological, chemical, and physical processes are at work making the lead unavailable" for absorption. Dr. Rufus Chaney, a USDA researcher, believes that, "Adhesion is a major factor in binding the metals. The high surface area of the dusts in N-Viro Soil probably accounts for its greater success in reducing the bioavailability of lead."

Dr. Chaney will lead a field research project that will replicate the lab work. In addition to animals, lead concentration in plants will also be measured in the field study.

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yard debris, bio-solids, vegetative food waste and other organics into humus-rich compost. For large-scale compost makers, not only was diversion of organics from landfills a concern (at least for states with mandates), but marketing the end-product has had its challenges. Compost marketers must often educate potential users who are more accustomed to petro-chemical fertilizers. A valuable resource, *Winning the Organics Game: The Compost Marketer's Handbook,* by Rodney W. Tyler (1996), describes the huge market potential awaiting compost producers. Interestingly, in this thorough treatment of compost utilization for a wide variety of markets, absolutely no mention is made of vermicompost, obviously a dark-horse candidate in the field. The fledgling vermicomposting industry shares a close kinship with the more established composting industry, but the contribution earthworms can make to soil fertility remains poorly understood by many.

"Vermicompost outperforms any commercial fertilizer I know of. Why this is true I'm not sure, since the nutrient value of worm castings is not high compared to chemical fertilizers. I think the key factor is microbial activity."

Research in the utilization of earthworms in waste management and their benefits to soil fertility is gradually trickling into the mainstream. Plant-growth trials are being conducted at Ohio State University and other institutions where the properties of worm castings are being studied. Leading earthworm scientist Dr. Clive Edwards has stated, "Vermicompost outperforms any commercial fertilizer I know of. Why this is true I'm not sure, since the nutrient value of worm castings is not high compared to chemical fertilizers. I think the key factor is microbial activity. Research that I and others have done shows that microbial activity in worm castings is 10 to 20 times higher than in the soil and organic matter that the worm ingests" (*BioCycle*, October, 1994, p. 63).

Edwards has been instrumental in commercial aspects of vermiculture by his association with the continuous flow reactor, a mechanized vermicomposting system in which tons of organic material may be added to the top portion of an elevated worm bed while the castings are removed from the bottom.

Redworms, principally the species *Eisenia fetida*, process the waste into vermicompost. But not all vermiculture enthusiasts are in agreement concerning systems or species of earthworms. Uday S. Bhawalkar of Pune, India is an advocate of what he calls "Vermiculture Ecotechnology," a system involving the application of organic material to worm beds using an anecic or soil-dwelling earthworm, *Pheretima elongata*. However, epigeic (litter-dwelling) redworms, contends Bhawalkar, are "pests" in the same category as cockroaches, ants, rats, flies and mosquitoes. "Redworms assimilate about 80 percent of the food nutrients," claims Bhawalkar. "Their excreta (that is, vermicompost) therefore contains 80 percent less nutrients as compared to the organics fed to the redworms." Not fearing to disagree with the majority of compost researchers, Bhawalkar considers composting to be the equivalent of "bio-incineration" and calls compost "bio-ash." He says compost "has no value as a culture of beneficial soil bacteria."

'The major lesson to be learned as a soil ecologist is one of paying attention to details, yet considering them in a holistic perspective.'

Bhawalkar's system of vermiculture ecotechnology calls for land application of raw organic material layered with rock dust and placed within the root zone of plants or trees. Earthworms, feeding on bacteria, produce castings of about 5 times their body weight per day, he claims, and manage the soil ecosystem so as to produce maximum plant production. Rock dust controls the pH and supplies a grinding medium for earthworms. In the U.S., Bhawalkar's disciples are found on both coasts, at the University of Oregon's Urban Farm in Eugene, and at the Banks of Eden Farm in Eden, Maryland.

Students of soil remineralization know that *Bread From Stones'* author Julius Hensel in 1893 decried Justus von Liebig's isolation of, and assertion that just a few minerals are indispensable. The full spectrum of minerals is necessary in optimum soil fertility. But soil is made up of more than its mineral component. As soil ecologists continue to study the complexities of the soil foodweb, there is greater appreciation for the role of each organism and chemical element in nature. University of Georgia soil scientists Coleman and Crossley wrote in Fundamentals of Soil Ecology (1996), "The major lesson to be learned as a soil ecologist is one of paying attention to details, yet considering them in a holistic perspective."

"Closing the loop" is both a goal and recognition of the circularity of nature. The well-known carbon cycle supplies a simple model. "Recycling" is simply following nature's pattern. Efforts, for example, in using cement kiln dust, a waste product, combined with bio-solids to create a soil amendment, illustrate effective recycling. "Wastes" such as yard debris, the organic fraction of MSW, bio-solids, vegetative food residues, and manures from herbivorous animals can be thermophilically composted, vermicomposted, or land-applied in vermiculture ecotechnology. Rock dust from quarries can be put to use agriculturally, and is necessary where minerals have been mined through intensive crop propagation. Waste recycling is resource recycling. Soil fertility, plant vitality and the health of animals and humans are inextricably interrelated. If we put it all together, our need for food supplements might vanish. RE

The eco-logic of vermiculture

Earthworms, bacteria enjoy symbiotic relationship

By Uday Bhawalker

Reprinted from *Worm Digest*, Winter 1995.

Each organism has a role and occupies a niche. In fact, it was shown by Russian ecologist, Gause, about 30 years ago that each niche has only one organism with its specific food. If another organism is introduced, it either gets wiped out or creates its own micro–niche by living symbiotically with the first, for example, by using the waste matter of the first organism as food.

Ecology of worm bins

Let us use eco-logic to understand the ecology (ecology: the relationship between organisms and their environment) of worm bins. Worm bins are meant for bioprocessing of organic wastes. In a worm bin organics are consumed by diverse organisms and those who are fast out–compete those who are slow.

It is a fact of life that small organisms such as bacteria are voracious eaters. Their appetite could be 20,000 times that of a man when compared on equal weight basis. Next in size come the fungi. Fungi have smaller appetites since they have about 100 times larger body size and anaerobic bacteria have poor appetites due to the unavailability of oxygen. All the other large organisms (worms and humans included) have smaller appetites relative to their weight.

What then prevents the bacteria from out—competing the larger animals for the available food? If bacteria, fungi, and worms are competing for food in a worm bin, obviously bacteria would win due to their speed of food consumption and growth. Given ideal conditions of temperature, moisture, pH and aeration, bacteria can double their population in 20 minutes, fungi, in 3-4 hours while worms take days. This speed of reproduction coupled with their voracious appetite mentioned above make beneficial bacteria the clear winner if conditions are suitable for them.

Beneficial bacteria in the composting process prefer a neutral pH and about 50 percent moisture which allows good aeration in the mass of decomposing organics. Fungi come into play only when bacteria slow down due to low moisture or acidity. Stale bread, for example, would develop fungal growth when the moisture level is too low for bacteria. Composting starts with bacteria but it will soon change over to fungal mode due to the acidity produced by the bacteria. If this acidity (normally produced in the process of decomposition) is coupled with higher moisture content (above 75 percent) the process becomes suitable for redworms and they will become the dominant processors.

Thus, redworms have a role when the pH becomes acidic and bacteria slow down their activity. It is found that redworms grow faster and eat fastest when the pH is around 5. Redworms consume the acidic food and produce alkaline excretions, thus shifting the pH to neutral, which is more suitable for bacteria. Once the wastes that are creating the acidity have been consumed by the redworms their population will diminish as their job is completed and the environment will be less suitable for them.

The role of burrowing earthworms on the other hand is one which is played symbiotically with beneficial bacteria, as they both prefer the conditions of neutral pH and 50 percent moisture. And, since in its role as a soil processor, the earthworm ingests these bacteria, the gut of the earthworm is a prefect natural bioreactor which provides an ideal breeding ground for these beneficial aerobic bacteria while at the same time destroying anaerobic bacteria, fungi and pathogens.

Although this process utilizing burrowing earthworms can be carried out most simply and efficiently directly on the soil, it is also possible to have a worm bin with earthworms in it as long as there is 3-4 inches of soil as bedding and a neutral pH and a 50 percent moisture content are maintained. A neutral pH is maintained in part through the use of rock dust, which is added each time food wastes are introduced to the system.

Nature's warning signals

When organics are processed around neutral pH and create no odor, the process is hygienic. Bacteria that grow at neutral pH are mostly beneficial soil bacteria that produce several growth factors that are needed by plants. Safe processing of organics takes place without emitting and signals such as odor and pests.

When the pH becomes acidic or alkaline or the organics become anaerobic due to a shortage of oxygen, the organics become anaerobic due to a shortage of oxygen, the organics may be processed by pathogens and toxin-producing bacteria. This amounts to a kind of biological fire (biofire). Such biofire is sensed, alarmed and remediated by pests such as rats, flies, etc. They provide us with a visible sign that warns of an unhealthy situation.

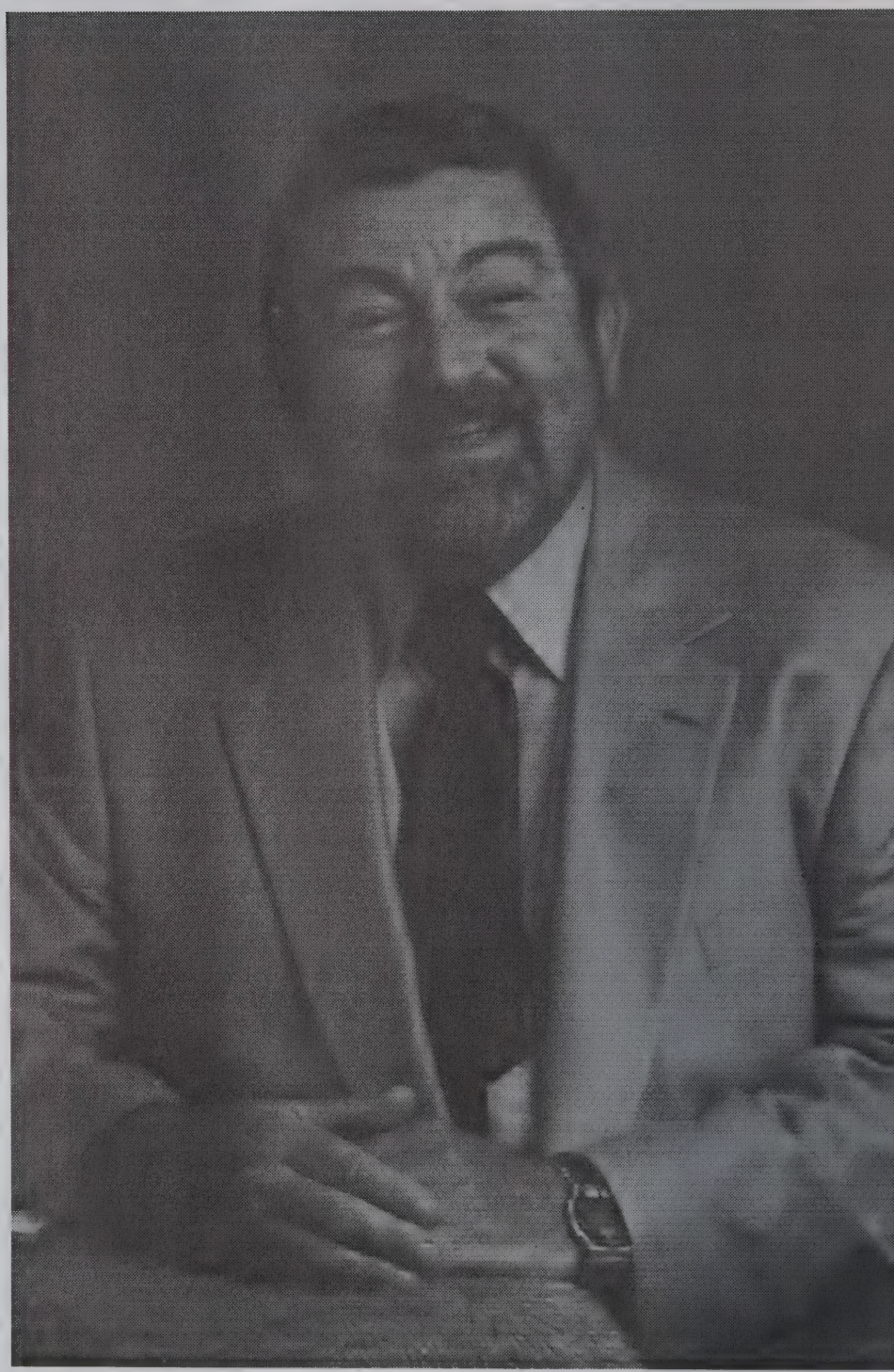
So if your worm bin attracts pests, they are probably involved in a fire-fighting service. We can help them by sprinkling lime or fine rock dust on the composting mass, which will return the pH to neutral and encourage speedier processing of the organics into excellent pant food. When the job is being well done, it displays no warning signals.

This summation of Uday Bhawalker's work to the present date has been compiled by him in a 380-page treatise which he has entitled Vermiculture Ecotechnology. *To receive more information including a list of the table of contents please send $5.00 to Worm Digest, Box 544, Eugene,* OR 97440. RE

Health

ABOUT THIS SECTION

- The role minerals and trace elements play in biology, health and medicine
- The relation of soil minerals to plant and animal health, immune functions
- The biological interactions of minerals
- Minerals in food



"The Center for Disease Control tells us that one-third of all Americans are chronically ill. Contrast that to 50 years ago, when it might have been 5 to 10 percent of the population. This is a serious, and it's a growing, segment of the population. It's estimated that by the year 2,000, about 50 percent of America will be chronically ill."

—Dr. Robert J. Marshall

& Nutrition

Fire in the Water

Dr. Gerald Olarsch on trace elements, electrolytes, and life

BY DAVID YARROW

A STORY IN TWO PARTS

Sparks of Life

Lightning strikes Earth over 1000 times a second. These fiery bolts from the blue are five times hotter than the Sun, as electrons surge from sky to soil in split seconds.

Scientists believe lightning ionized simple molecules in Earth's primeval ocean to synthesize the first amino acids — life's basic chemical building blocks. Thus, Heaven's fire was captured in early Earth's waters to give rise to life.

Lightning brings death, too. In the U.S., lightning kills 200 people a year — more than hurricanes or tornadoes.

Lightning struck the Earth beside the well of Jerry Olarsch's North Port, Florida home. The electric bolt shot through metal pipe to the house, where it blew circuits, damaging $12,000 worth of sensitive electronic appliances. At that instant, Jerry was holding his well's water pipe. Thrown thirty feet by this blast, he fell to the ground unconscious.

Minutes later, he revived. Dazed, stunned, those moments remain a hole burned from Jerry's memories.

Remarkably, his body wasn't burned by this burst of intense electric fire. But troubling, confounding symptoms persisted, leaving him debilitated, unable to work or play. Blood pressure zoomed and he suffered chronic fatigue. Confused thinking, incoherent perception, scrambled speech, muddled memory, buzzing sensations in his head were signs his nervous system and brain weren't functioning. Getting out of bed each morning became a huge enterprise.

In a quest for relief from these puzzling effects of his freak accident, Jerry went from doctor to doctor, eventually visiting Chicago's Mayo Clinic. But no medical expert could diagnose Jerry's condition, or remedy his disturbed body and brain.

At last, his son David, a Naturopathic physician in Plymouth, New Hampshire, suggested a trace mineral electrolyte developed by New Jersey scientist Dr. George Earp-Thomas in the 1940s.

"Dad had been sick quite a while with chronic fatigue symptoms," recalled Dr. David Olarsch, "couldn't even take out the trash. I started thinking about lightning and electricity: how does it change the body? Hurt adrenal glands? Definitely! Fry something in the nervous system? Likely."

"The body is electric," David reflected. "A lot of healing is about how molecules and electrons spin in the body — positive and negative. So I thought about the electrolytes. I remembered in my childhood my dad worked with them and saw amazing things happen. When all else failed, they would work."

◄ Dr. I. Gerald Olarsch, N.D., known in the field as "Dr. Jerry."

The Criminal-Mineral Link

Contributed by the National Health Federation

In the 1970s, William J. Walsh, Ph.D., was conducting chemistry and physics research at Argonne National Laboratory, near Chicago. He was also doing volunteer work with inmates at the Stateville Penitentiary in Joliet, Illinois. Most of the violent criminals had very troubled childhoods, but Walsh questioned whether their behavior was entirely the result of upbringing.

Walsh compared the mineral levels of forty-eight pairs of brothers, mostly teenagers. In all cases, one brother was considered and "all-American boy" and the other very violent. The experiment was a "fishing expedition," because Walsh wasn't sure what he would find, he told doctors attending the 25th annual Nutritional Medicine Today Conference. But the findings were significant. The violent brothers had one of two distinct patterns of mineral imbalances. These patterns remained consistent, regardless of race, when Walsh went on to compare mineral levels between violent imprisoned criminals and normal, law-abiding people.

One of the criminal patterns was a high copper-to-zinc ratio; low levels of sodium, potassium and manganese; and high levels of lead and cadmium, which are toxic. People with this mineral pattern generally displayed extreme mood swings, poor responses to stress and occasional violent behavior. They did, however, feel remorse about their actions.

The other mineral pattern consisted of very low copper, very high sodium and potassium; high lead, cadmium, iron and calcium; and low zinc. These people were often very violent, pathological liars, cruel and fascinated by fire. They also exhibited no conscience or remorse for their actions. RE

But no one was making this unique substance anymore, so Jerry borrowed space in a friend's lab and undertook the tedious, precise procedure to prepare a batch. Soon he was taking one teaspoon stirred in a glass of spring water four times a day.

Charge of the Lyte Brigade

Three months saw a 40 percent improvement. Then, the next three months were even more dramatic. In a year, all symptoms were relieved and he could return to work. Indeed, if anything, he felt better than before the lightning strike.

David reminded Jerry how many people were once helped by the electrolytes, and urged his father to make them again. So Jerry set up a lab in his Florida home to manufacture small batches for himself, his son and a few old friends. But word got out they were available and demand spread like wildfire.

The solution to Jerry Olarsch's disabled biology is a carefully prepared blend of eleven elements in homeopathic dilution. It looks, tastes and tests like crystal clear, pure water, yet this fluid is charged with power to transform biochemical chaos to organic order — and thus sickness to health. But its power isn't chemical potency, but a special electromagnetic energy that is created and transmitted to the body. Its preparation is a precise recipe whose ingredients are simple; the procedure a complex and secret formula.

Because these electrolytes are biologically made, they don't need to go through a digestive process, and thus are easily and rapidly absorbed through soft tissues of skin and mucous membrane. This special solution of minerals-in-water absorbs directly through cell membranes, so the minerals are quickly ready to use in synthesis and enzymes.

"These electrolytes involve a very intricate process to make," said Jerry. "It took thirty years of tedious research to develop them, and it takes a week to make a batch. The Nature's Path label lists the three healers: 'Nature, Time and Patience.' That came literally out of learning how to make the electrolytes. Everybody wants miracles tomorrow, but it just doesn't happen. Part of the process involves rock enzyme activity to create electric charge."

Animal, Vegetable, Mineral

Electrolytes begin as minerals — the inorganic, hard rock of our planet. Of the major types of nutrients — mineral, carbohydrate, protein, and oil — minerals came first. They existed on Earth before plants or animals, before sugars or amino acids. These simple elements can't be synthesized by plant, animal or human, but must be integrated into the dust and stones in soil. There are no substitutes for these essential elemental nutrients.

Biology turns stones into bones. Our human body is 99.5 percent hydrogen, oxygen, carbon, and nitrogen — only four lightweight elements. The other .5 percent is minerals, most of which form our hard, dense skeleton. Being the least, lowest and simplest of all nutrients, minerals are also the most taken for granted. And while humans don't eat rocks, we can't live without minerals, which must be supplied continuously in the food we eat.

Minerals are metallic elements, but most metals carry so much charge, they are rarely found as pure elements. Instead, they react

chemically with other atoms to form oxides, chlorides, sulfides, sulfates, silicates, carbonates, etc. The metal atoms in minerals are the centers of charge in large molecules that form cells and living tissues. The metal elements coordinate and direct the flow of electrons, reaction of atoms, strength of membranes, and action of enzymes in biological life. Thus, metalic elements become mineral as the first step to becoming biology.

Like a penny in the U.S. economy, an electron is the common currency of chemistry — smallest singular unit of spin — or charge. An electric current is a stream of electrons through subatomic space. And, like a penny is the smallest coin, copper is the conductor of choice for electricity (although other metals will work, too). A spark is a burst of this electric fire made visible in a massive discharge of electrons in air — miniature lightning. How atoms share, pair, pass around, circulate, and store electrons decide how ions form, atoms bond, molecules are made, carbons chain and cells sing.

"The body is electric," David reflected. "A lot of healing is about how molecules and electrons spin in the body — positive and negative. So I thought about the electrolytes."

An ion is an atom that gains or loses one or more electrons. Since such an atom then has an excess or shortage of electrons in outer orbitals circling around the nucleus, an ion has electric charge. This gives ions the essential energy needed to power chemical reactions. Some elements — mostly metals — easily release electrons to have positive charge: a cation (+). Others capture extra electrons to acquire negative charge: an anion.

For example, Sodium (Na), one of the lightest metals, easily gives up the single, unpaired electron in its outermost orbital to become a cation (Na+). But it's positive charge is so strong it rapidly bonds with other atoms. Tossed in water, a pure pellet reacts with such quick vigor it explodes with a loud, violent "pop!" So, we seldom encounter sodium as pure metal, only as its mineral salts.

So too, most metals react with oxygen, hydrogen, nitrogen, sulfur, chlorine, etc., to become minerals. These crystal chemicals become Earth's bedrock, boulders, stone, soil, clay, sand, silt and salt.

Biological Plasma

Even slight alterations in concentrations of ionic chemicals in our body fluids will disturb vital cell functions. For example, low potassium ions cause general muscle paralysis, while high levels create weak, irregular heartbeats. Therefore, our body has evolved with multiple methods to maintain stable, constant levels of electrolytes in blood and all other body fluids.

"A 1992 study published in the European Journal of Heart Disease," Jerry elaborated, "revealed a relationship to minerals in water in seventy-six Swedish communities. Cities with the highest mineral content had the lowest incidence of heart disease."

"That same scientist also studied enzymes that keep Eskimo arteries clean. Eskimos eat a high fat diet, yet still maintain excellent health. Because they eat a natural, highly mineralized diet, their bodies produce the necessary enzymes," concluded Olarsch.

In final form, Jerry's electrolytes are far beyond chemical interactions. In his biological method of production, over the course of a week in a vat, minerals are transformed into a special state by bacteria. They acquire an added energy force. If you try to measure it, it's not detectable. This force isn't exactly a mystery, but is subtle beyond humankind's most sensitive instruments.

The best way to describe this state is that minerals change form to become energized like plasma — a living water, in complex stable, yet changing states of charge. In fact, by coincidence, the medical term for the fluid in blood is "plasma". And in physics, "plas-

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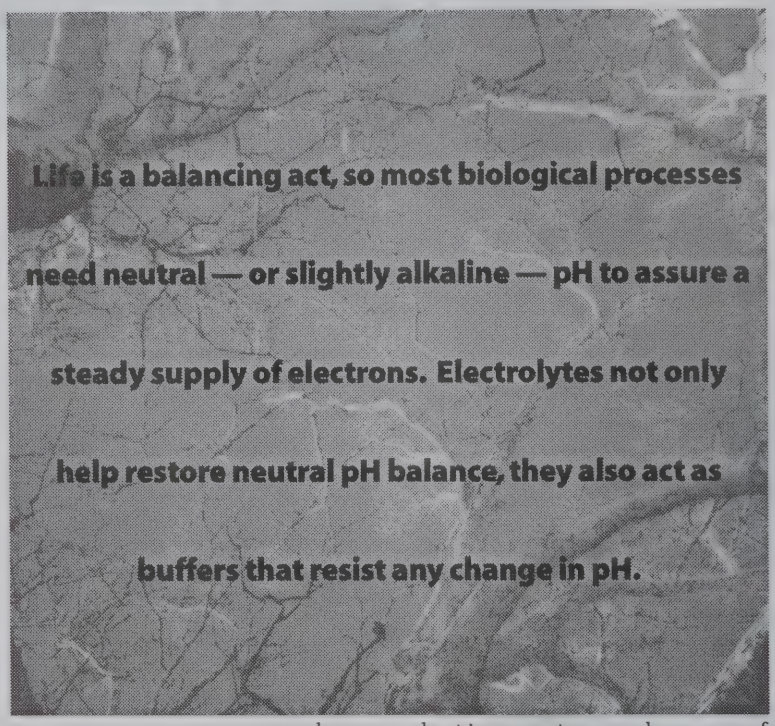
ma" is the fourth state of matter, in an ionized, electrified state.

"There are over seventy trillion cells in a human body," explained Jerry. "Each cell is a tiny drop of water enclosed in a bubble of oily membrane."

"The force between the inside and outside cell wall," Jerry went on, "is a liquid pressure that's sustained by electrolytes. Minerals are needed to keep this battery in a cell going, and to enable cells to hold charge. Without minerals — without the right electrolytes in correct ratios — cells can't maintain this inner-outer pressure, weaken, become vulnerable to parasites, even die."

"Cell membrane is a key element in immunity," I noted.

"If our body were a car," Jerry proposed, "electrolytes would be the battery and sparkplugs. A car won't run without a battery and plugs. Just so, without these living waters, we can't be healthy. And if we don't recharge our biological battery, we're as worthless as a car with a dead battery."


Life is a balancing act, so most biological processes need neutral — or slightly alkaline — pH to assure a steady supply of electrons. Electrolytes not only help restore neutral pH balance, they also act as buffers that resist any change in pH.

Identity and Immunity

A cell's most critical chore is to maintain the integrity of the cell membrane — the inner-outer pressure balance at a cell wall to separate cell from "not-cell". This double layer of lipids is in constant motion, fed by electrolytes. A strong membrane is a cell's first line of defense — the front-line of the immune system. Without electrolytes, this barrier can't be sustained, weakens, and a virus or bacteria can invade the cell.

Trace element electrolytes are key catalysts in thousands of enzymes needed by cells to make amino acids, proteins, and other organic molecules. When electrolytes form, they generate more electro-chemical activity, attract more minerals, capture more charge. Charge control is the key to enzymes that allow biochemical reactions to occur rapidly, selectively, precisely. Zinc, for instance, is used in over 20 enzyme systems.

For example, the pancreas produces enzymes and acids to break food down in digestion. Drinking electrolytes thirty minutes before a meal moistens and recharges soft tissues lining the digestive tract. Then, when you eat, membranes and micro-organisms are ready to digest and absorb food. But further, electrolytes supply the pancreas new ions to make more digestive enzymes.

Electrolytes are also critical to nerves — both individually, and in collective coordination of the entire nervous system. Nerve impulses are transmitted as an exchange of sodium and potassium ions at the nerve membrane. The nerve membrane is encased in long tendrils of protein with a calciuim ion attached at the end of each strand. Without this impulse of ion fire, there can be no taste, no smell, no sight, no sensation, no awareness.

Hormones, vitamins and enzymes which activate, regulate and synchronize nerve action all require a mineral ion as key element in their reactive structure, and especially for synthesis. For one, the cobalt in vitamin B12 is needed by the pineal gland to make melatonin, the hormone which regulates neurologic function, determining the level of sleep or wakefulness.

This touches only a few of the many profound, essential roles of these mineral ions in blood chemistry, cell biology and human physiology. Electrolytes are the key to unlock energy flow in a cell. They strike the sparks of electric fire that make life happen.

Electrolytes supply the spark to cells. They aren't fuel that is burned to provide power. Rather, like a spark in a car engine, they are the electric fire that ignites every chemical reaction in a cell. They deliver electrons where needed for reactions, and store charge between events. Electrolytes strengthen every cell, gland and organ.

Electrolytes sustain the most critical chemical balance in the body — pH, the acid-base balance. This delicate chemical condition determines how available electrons are for reactions. Too much positive charge from acids (+) creates an inability to circulate electrons. Excess anions (ñ) of an alkaline state will overcharge a cell or organism.

Life is a balancing act, so most biological processes need neutral — or slightly alkaline — pH to assure a steady supply of electrons. Our blood remains very close to 6.45 pH, and if it changes by .1, we can die. Electrolytes not only help restore neutral pH balance, they also act as buffers that resist any change in pH.

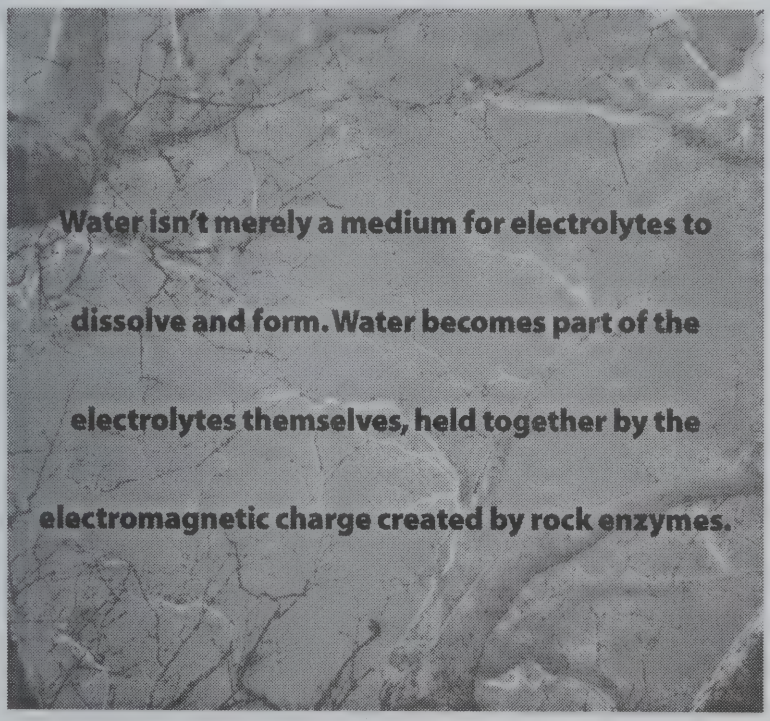
"The neutral factor," explained Jerry, "means if we eat something that's too acid or alkaline, our body can prevent a change in pH. A healthy body with electrolytes will temporarily neutralize these extremes. My electrolytes contain bicarbonates, so they cre-

ate neutral factor to buffer body fluids and neutralize anions and cations if positive or negative charge is too strong."

Like Earth's polluted air, blood and lymph have become too acid — not occasionally, but chronically and critically. Like trees dying on high mountain-tops from acid rain, intestinal microflora wilt and weaken if the pH of their environment changes. When the pH of cell water becomes too acid, proteins change their shape, and many enzymes no longer function.

"Much modern illness is due to disturbed pH. Infections, yeasts, parasites, and worms all thrive in acid pH. Cancer and arthritis are two of many diseases encouraged and aggravated, if not caused, by inability to sustain stable, neutral pH, and thus cell membrane integrity.

"For example, osteoporosis is rampant in the U.S., the wealthiest nation on Earth," Jerry said. "Chronic excess acids force our body to use calcium stored in teeth and bones to neutralize acids. Our poor, depleted soils can't supply minerals needed for electrolytes, while refining and processing remove even more minerals, so we can't generate the electromagnetic charge. No matter how much supplement we take, calcium can't adhere to bone matrix without this electromagnetic force."


Water isn't merely a medium for electrolytes to dissolve and form. Water becomes part of the electrolytes themselves, held together by the electromagnetic charge created by rock enzymes.

Energizing Water

Originally, minerals from Earth's rocks were dissolved by rivers and rains, which washed soluble salts into oceans. We absorb minerals best when they are dissolved in water. Therefore, Trace Lyte® begins as a solution of minerals in water.

"Water must be of absolute purity," Jerry emphasized, "three major steps beyond distillation."

Water is the most important and abundant molecule in our body, and perhaps the least appreciated or understood. On Earth, water covers nearly 75 percent of our planet's surface, in all three of its phases: gas, liquid and solid.

Our body is 75 percent water by weight, most of which is lymph fluid. Our organs and glands float in this internal ocean, whose chemical composition and ion concentrations are carefully controlled. In our body, water exists in all three states: vapor, fluid and crystal. And a fourth state: plasma.

Water — the universal solvent — plays a key role in cell and body. The first organisms — bacteria, plant and animal — evolved in Earth's early ocean. Water is the medium in which all biochemical reactions occur. Most nutrients are dissolved in water. Water liquifies food to carry nutrients through intestines where they are absorbed into the bloodstream and lymph. Animals on starvation diets still survive, even after losing all stored fats and carbohydrates, and half their protein. But loss of 10 percent of their water is very serious, and 20 percent loss usually results in death. So water must be drunk steadily to prevent dehydration, and maintain fluid, electrolyte and pH balances.

Most critical, and least understood, is water's ability to transmit energy. Wind making waves on oceans and lakes, and the ever-flowing currents of rivers and oceans portray water's ability to capture and carry energy. In cells, wave energy is not only a current of electrons, but magnetic flux. These properties are altered by electrolytes.

Water isn't merely a medium for electrolytes to dissolve and form. Water becomes part of the electrolytes themselves, held together by the electromagnetic charge created by rock enzymes.

Cell protoplasm, like the rest of the body, is mostly water. But not ordinary water. The water in Tracelyte® (has certain ions added in careful, precise amounts, and then electromagnetic charge is imparted. This force imposes definite yet subtle order to water molecules. Cell biology calls fluid inside cell membrane "gelatinous" — leaving this mystery murky and amorphous.

Trace Elements

To his pure water, Jerry adds carefully chosen and measured mineral salts: two major elements (sodium and potassium) in parts per thousand and nine trace elements (copper, iodine, manganese, zinc, cobalt, selenium, chromium, silica, and boron) in parts per million or less (see Table 2).

"First, minerals must be super-pure," revealed Jerry. "We can't afford contamination with other elements, or electrolytes won't form. Proportion is more critical than amount.

"Second, measuring is so precise and exact, I spent $5,000 for a laboratory scale to weigh them. Minerals are measured down to exact micrograms, and can't be off by a hair or they won't go into solution, but drop to the bottom of the tank. You must be an experienced biochemist to weigh them.

"Third, only certain minerals will form these electrolytes. For instance, there's no iron in the formula. This essential mineral won't allow electrolytes to form — maybe cobalt is a precursor. But drinking the electrolytes creates an electromagnetic energy in the body that will pull iron out from food, and out of the blood and into cells."

"Iron is magnetic," I observed.

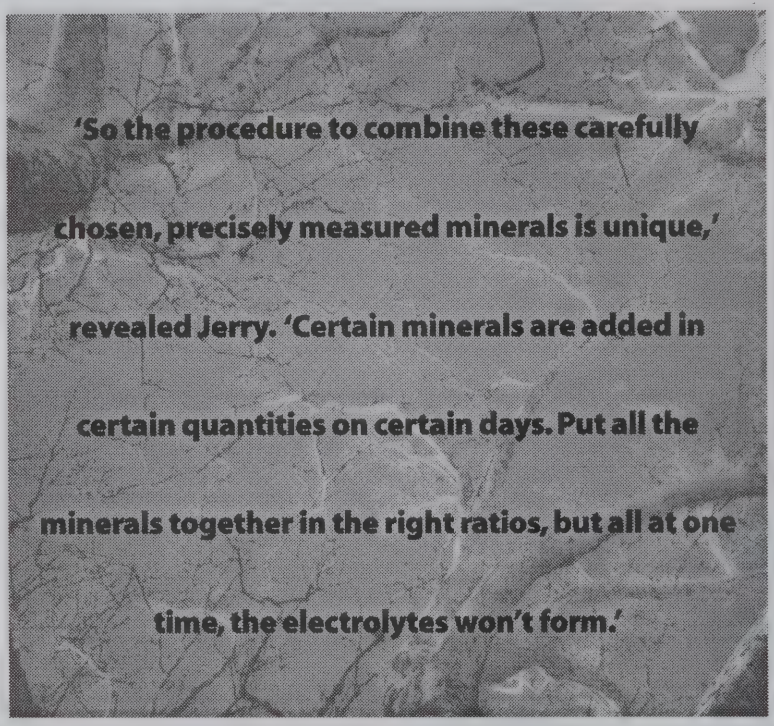
Trace elements are the proverbial needle in a haystack. "In this condition, the minerals are so dilute," revealed Jerry, "it's like pure drinking water. The label says 'in homeopathic form'. Very, very minute mineral content — trace amounts of trace elements."

They are just as essential as carbohydrates and protein, but needed in minute amounts. For example, we need little more than a millionth of an ounce of iodine, but if it's lacking, goiter develops from a dysfunctional thyroid.

"Take silica," Jerry said. "A cell wall can't have elasticity unless it has a bit of silica. As we get older, lack of silica causes skin to harden and age rapidly. But with silica, we know people's skin stays younger."

Combining these elements is tricky, since minerals have complex interactions with each other and other nutrients. Some are beneficial, but many are antagonistic. For example, zinc interferes with copper and iron absorption, while copper enhances iron uptake, but inhibits molybdenum. Cobalt is antagonized by molybdenum, and unfriendly to zinc.

"So the procedure to combine these carefully chosen, precisely measured minerals is unique," revealed Jerry. "Certain minerals are added in certain quantities on certain days. Put all the minerals together in the right ratios, but all at one time, the electrolytes won't form."


'So the procedure to combine these carefully chosen, precisely measured minerals is unique,' revealed Jerry. 'Certain minerals are added in certain quantities on certain days. Put all the minerals together in the right ratios, but all at one time, the electrolytes won't form.'

Mineral into Microbe

Recently, some hospitals began to add zinc, chromium, copper, and manganese to intravenous fluids, a sign medical staff now recognize a need for these nutrients. They now know trace elements affect white blood cells — a key to our immune system, which resists disease and infection. But medical science has just begun to understand how to effectively supply essential minerals to a living body, or even a single cell.

Nature's Path

Recovery from lightning strike wasn't Jerry Olarsch's first encounter with these extraordinary electrolytes. He first got personally involved with them as a health-saving measure while still a young man.

"I was born sickly," Jerry confessed. "I never knew a day of feeling good. Every morning my mother put drops in my eyes. I was constantly with doctors, and had little opportunity to play with other kids. So I learned to read, study, and do research. While at Newark College, I developed internal bleeding, and doctors said I had to have an operation. I was desperate.

"Someone told me about a laboratory in New Jersey," Jerry continued, "where Dr. George H. Earp-Thomas of New Zealand was doing advanced research in natural health care \— advanced for those days. So I went there, and was told to take electrolytes, wheat grass and acidolphilus.

"I remember in my early endeavors to get healthy by taking electrolytes, I went through a cleansing crisis, then slowly got better for the first time in my life. In a year I was able to get rid of every medication. My improvements were so dramatic — that first year changed the course of my life. After several years of college, I went to study Naturopathic Medicine in Canada.

"Naturopathic Medicine uses only natural methods that are in harmony with Nature. This may be foods, diets, fasting, nutritional supplements, exercise, herbs, chiropractry, or other treatments. Naturopathic doctors don't use synthetic drugs and toxic chemicals which can cause harm.

"Being young, I was fortunate to have the intestinal fortitude and strength to succeed. I got a graduate degree from the Naturopathic College of Quebec in Montreal, and studied with Dr. Raymond Barbeau, who did amazing work in the 60's on nutritional causes of cancer.

"When I returned to New Jersey, I worked at Earp Laboratories, and learned a great deal more. I worked there off and on from 1950 to the early 60's. It was then Dr. Henry Schroeder at Dartmouth published his book on trace elements. The book died on shelves. Nobody cared about nutrition — even less about trace elements. The same indifference afflicted Earp-Thomas' research discoveries."

Genius in Jersey

After the turn of the century, Dr. Earp-

Thomas acquired a small farm in southwest New Jersey. There he kept cattle, and grew grains, vegetables and fruit. One day he noticed his cows stretching their necks through fence to lick earth along a freshly laid gravel roadbed. Fascinated, Earp-Thomas ran an analysis with the crude equipment of his time and found the missing ingredient his cows were straining for. It was cobalt.

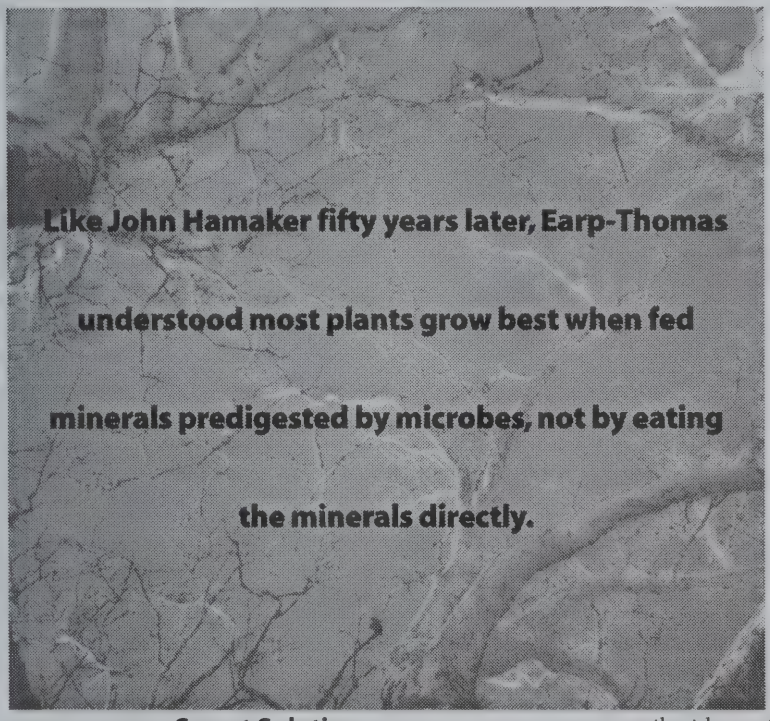
The amount of cobalt we need fits on the head of a pin. Yet, if we don't have it, we die. This trace of a trace element has only one purpose: Vitamin B12, a nutrient needed in micrograms a day (not milligrams, like other vitamins) requires it for synthesis. Cobalt is essential for function of nerves and the whole nervous system, red blood cell synthesis, DNA replication, pineal and pituitary hormones–our most crucial biological functions.

Cobalt is also one of three naturally magnetic elements. B12 isn't really a chemical vitamin, but a magnetic hormone whose key ingredient is a heavy metal trace element. And, contrary to popular myth about this "vegetarian vitamin", B12 is made — not by animals — but by bacteria.

Earp-Thomas realized cows had the natural instinct to know they needed cobalt, and the sense to find it. He also realized this meant his farm's soils lacked this essential trace element. This started Earp-Thomas off on a series of brilliant discoveries with minerals and soils.

Not satisfied with instruments then available to measure mineral, he invented the first device sensitive enough to detect them in parts-per-million. With this, he showed New Jersey soils were losing minor and trace elements. And so were crops grown on those soils.

"That's the bottom line: Nature hath provided, but man has taken away," Jerry proclaimed. "Even the Bible says we are born out of the dust of the Earth — the minerals. Earp-Thomas said in the 30's after the Dust Bowl: 'If we don't put minerals back in those soils — and our water supply — we'll see a scourge of diseases like the Bible couldn't imagine.' And low and behold," Jerry intoned, "it has come to pass."


Like John Hamaker fifty years later, Earp-Thomas
understood most plants grow best when fed
minerals predigested by microbes, not by eating
the minerals directly.

Secret Solution

In the 1930's, Earp-Thomas discovered that without minerals, cells can't maintain cell wall pressure, become weak and susceptible to infection and disease. This insight inspired his careful study of how minerals become biology. He began to devise natural ways to deliver minerals to cells as electrolytes in biological — not merely chemical — form.

Earp-Thomas worked on the electrolyte formula diligently. He determined which elements to put in Trace-Lyte® not by guesswork, but by observing mineral uptake in wheatgrass he grew organically on his farm. That experience gave him a formula, which he followed with patient trial and error. Careful observation of repetitious experiments were required. By 1938, he had a crude stage of electrolyte ready, using a three phase process: water, bacteria and electromagnetic spin.

Earp-Thomas worked at Pasteur Institute in 1910-12 with Eli Menchnakov on intestinal bacteria. When this brilliant research scientist moved to New Jersey to start his own laboratory, he brought a profound curiosity for the microbial world. He was an early pioneer in a new field — Biotechnology — now touted as the future of science, medicine and industry.

"He came to the U.S. with several strains of intestinal bacteria, which Menchnakov told him to grow and re-grow," Jerry explained. "Which Earp-Thomas did, and these strains became very potent. He was the first to work with acidophilus cultures to revive weak intestinal microflora before anyone knew about yogurt or miso. I maintain some of these strains to this day."

Earp-Thomas kept an active interest in bacteria, methodically studying them. Like anyone who sees soil with a microscope, he saw dirt is not inert, but alive and teeming with minute forms of life. Fertile soil's dark color is due to silent, unseen bacteria.

Earp-Thomas realized that the main food of microbes is minerals. Earth's tiniest organisms convert inorganic ions into living protoplasm, which then becomes food for more complex lifeforms. Like John Hamaker fifty years later, Earp-Thomas understood most plants grow best when fed minerals predigested by microbes, not by eating the minerals directly.

A primitive example of bacteria-plant symbiosis are lowly lichen encrusting boulders, feeding on sunshine and rock. Lichen is a partnership: bacteria supply pre-digested minerals, pre-packaged in protoplasm, to algae, which feed the microbes sugar from

sunshine. Similarly, most plants have partnerships with soil bacteria, trading sugar for minerals and nutrients.

A more complex exchange occurs between legumes (beans, peas, clovers, vetch) and nitrogen-fixing Rhizobia bacteria in root nodules. Trees — the largest, most complex plants — maintain microbial communities around their roots on a galactic scale of quantity and diversity.

Earp-Thomas appreciated bacteria as allies of life and health, not enemies. Healthy soil is a cooperating community of interacting organisms who feed and support eat other in a stable balance. In a time when chemical technology was a new rage of industry, farming and society, Earp-Thomas peered deeply into the fabric of life. But in the early 1900's, a war mentality infected the mindset of society, including paranoia about "germs".

Waste into Wealth

When studying infectious bacteria associated with pathology and disease, Earp-Thomas observed that mineral powders rapidly disrupt pathogenic bacteria. An abundant supply of elemental ions alters cell membranes to rapidly relieve infection and restore tissues to health. He observed similar processes at work in the fertile soil of his New Jersey farm.

With Rockefeller Foundation funding, the genius in Jersey sent teams all over Earth to gather samples of soil microbes from croplands, especially those living on plant roots. Eventually he accumulated an extensive library of microbes, and volumes of notes and diagrams on this complex microbial order.

"Earp-Thomas developed strains of bacteria to turn garbage into topsoil," Jerry's voice soared in excitement. "Literally, he had an entire solid waste disposal technology. He could put up a silo in a city and in 24 hours turn garbage into organic, odor-free fertilizer — that payed for itself. Cities were making money selling fertilizer.

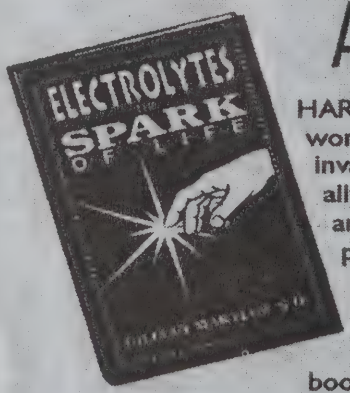
"Sounds like a dream," I said, "turning trash into cash."

"He had silos going all over the world." Then Jerry's voice turned somber. "Except the U.S., because landfills were gangster owned, and they didn't want his silos around."

Jerry's voice deepened, "Towards the end of that lab, there were no sales. What kept the lab going was the digesters and the fertilizers." RE

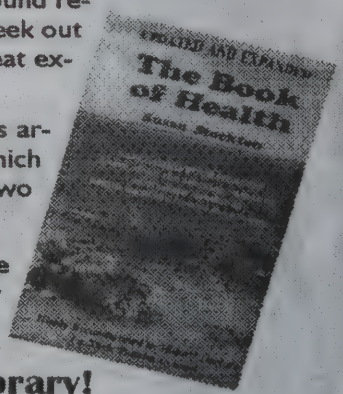
(End of Part One)

America's #1 Bestsellers?



HARDLY! . . . While many Americans are getting into natural health alternatives, most won't bother to read a book that might offer them a reasonable non-toxic, non-invasive, holistic approach that many Americans have found really work in rebuilding their health -without having to seek out an alternative health clinic in another country at a great expense.

With the incidence of degenerative diseases (such as arthritis, cancer, heart disease, osteoporosis, etc.) which are rapidly increasing in our society today, these two books are a MUST!



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Sources & Resources

Azomite — High Test for the Garden

ABOUT THIS SECTION

- Remineralization industry news and updates
- Sources of materials
- Technology for grinding and applying, product research, products, and services
- Producer profiles and information resources

Tim Carr stands among trees on his farm on Huelo, Hawaii. Photo: Denise Laitinen

By Tom Stevens
reprinted from *Haleakala Times*,
15 Oct.- 4 Nov. 1997

Over the past couple of years, an oddly compelling cassette tape has passed from hand to hand like an early copy of the Bible. "Dead Doctors don't Lie" argues that key trace minerals essential for health, vigor and longevity

have all but vanished from First World diets. The solution: put the trace minerals into little bottles and sell them pyramid-style for big bucks.

Huelo, Hawai'i, gardener Tim Carr has another idea: put the minerals into your garden.

"My mission is to get this into the hands of organic gardeners and farmers," says Carr, the new state distributor for Azomite, a mineral rock dust said to increase nutrients in soils and plants. "I've known about it for 15 years, but it hasn't been brought to Hawai'i in bulk."

That changed October 1, when Carr cracked the seals on a Matson container and inspected his first shipment: 32,000 pounds of Azomite stacked ceiling-high in 40-pound sacks. More than half the shipment was already pre-sold to Maui gardeners and landscapers, Carr says. The rest will be available to the public at Ha'iku lumber, next door to the Ha'iku Mart. The Azomite will retail for $24 a sack, with a price break after the first ten sacks. A $19 wholesale price applies to orders of a half-ton or more.

What is this stuff? According to Secrets of the Soil authors Peter Tompkins and Christopher Bird, Azomite is an "aluminum silicate clay admixed with various minerals, rare in the United States and even in the world, but much prized by medicine men of Indian tribes."

The clay formed on the sea floor aeons ago, the authors say, as a sedimentary silt of minerals and decayed seaweed, crustaceans and algae. When tectonic upheavals buckled the seabed upward, the clay came to rest in what is now Utah. There it lay for millions of years, embedded in a series of 21 pink cliffs from 200 to 500 feet tall. In the 1940s, the cliffs were prospected by San Francisco engineer, Rollin Anderson, who took samples of the powdery pink clay to nearby Salt Lake City for analysis.

Identified as "montmorillonite", the clay yielded nitrogen, phosphorous and potassium — agriculture's "big three" — and thirty-two trace elements and other minerals, including calcium, magnesium, cobalt, iron, manganese, zinc, copper, chlorine, sodium, sulfur, boron and molybdenum. The wide-ranging readout prompted Anderson to create and acronym for his find ("Azomite, the A to Z Of Minerals, Including Trace Elements") and to trademark the name.

PHOTOS: DENISE LAITINEN

Remineralized Hawaii: Tim Carr's little piece of Eden by Azomite in Huelo, Maui. Inset: Healthy, remineralized macadamia nuts, papaya, banana, avocado and oranges.

Now in his nineties, Anderson eats a spoonful of the pink dust with every meal and ships the rest to organic farms, orchards, poultry operations, sheep and cattle feedlots, and researchers worldwide. Whether applied to agricultural soil, spooned onto the roots of trees or fed to poultry and livestock, Tompkins and Bird report, Azomite has made its recipients stronger, healthier and more fruitful.

Ha'iku gardener Gary Moore is a believer. "I told him I'd take 300 pounds," Moore says when he heard of the Maui Azomite shipment. "It's no scam — it's part of a family of fossil sea bottom deposits that happen to be more potent than others elsewhere in the world. I grew up in a farming valley in Oregon in time to see the old style of composting and fertilizing with manure switch to DDT, 2-4-5-T and petrochemical crystals in huge boxes. Pretty soon every farmer had a spray rig on his tractor and thought he was going to get rich. Now they've got every kind of disease in that valley. There used to be a big honey industry there, but it died out along with the bees."

After moving to Maui, Moore explored the "French intensive" style of raised-bed organic gardening on his Ha'iku homestead. Twenty years of research and experimentation led him to "micronutrients", trace elements thought to optimize the energy exchange among sunlight, air, water, plants and soil. "Micronutrients and how they work with microorganisms in the soil–that's what organic gardening is all about," he says.

Without micronutrients, Moore continues, all the strenuous work of tilling, composting, and cultivating one's soil, sowing the best seeds, controlling insects and diseases

produces less than optimal results. "You've done everything else right, but you didn't use micronutrients."

Azomite importer Carr likens the trace minerals to "catalysts" and explains that they're finely ground in order to "increase the surface area for cellular and biological interaction" between the minerals and their recipients. Carr plans to keep a videotape history of Azomite applications on his own four-acre homestead in Huelo, where he and his wife Lynda raise fruit and nuts for Nature's Outlet and the Maui Juice Company. The 180-tree Carr orchard supplies two dozen products ranging from common isle fruit like mango, banana, coconut and guava to offbeat crops like mulberries, malabar chestnuts, Brazilian plums, "ice-cream beans" and star apples.

"We want to create an edible landscape integrated with arborculture," says Carr, a permaculture advocate who moved to Maui from his native Michigan in 1978 to design and build an "off-the-grid" organic homestead for an East Maui friend. After a twenty-year dual career in music and woodworking, Carr now wants to promote organic alternatives to environmentally damaging land stewardship systems.

"What I want to do with this is help golf courses and hotels to get off the petrochemical pesticide and fertilizer programs and use a totally organic long-term soil health regime," he says, alluding to recent reports linking agricultural and hotel runoffs to West Maui ocean algae blooms. "We need to better manage soil that has become depleted, eroded and compacted by heavy machinery."

One Matson container of Azomite isn't going to transform Maui, but Carr figures Maui Gardeners and landscapers can at least experiment with the stuff. "I'm going to mix it with compost to give it body, since it's as fined as talcum powder. I'll apply it at the drip rings around the trees, but not everywhere," he says. "You don't want to be fertilizing randomly with it, because you'll get accelerated grass and weed growth." Carr adds that Azomite can also be applied as a foliar spray if an agitator keeps it in suspension in the tank. RE

Earth Regeneration Society publishes new book

COMPILED BY JOANNA DEVINE

On September 23, 1997, the Earth Regeneration Society, Inc. sent the first announcement of their book *Broken Planet—Broken Systems: 15-Year Climate Stabilization Program for Humanity* to all U.N. members, all members of the United States Congress, and 500 U.S. individuals and organizations. The book lays out targets for climate stabilization by individual country. It was published and publicized to serve as a key international document for the Kyoto conference and the subsequent climate negotiations closing out this century.

Broken Planet— Broken Systems is the first publication to offer climate stabilization targets for each country's review. The book attentively includes goals and targets for all countries large and small, rather than omitting less developed economies from participation in the process of global climate stabilization. The Earth Regeneration Society cites the deterioration of many resource and human conditions since the 1992 Rio Conference on climate: "The San Francisco Chronicle , August 18 and 26, 1995, reported the results of freezing storms coming from the Antarctic, hitting southern Chile and Argentina, freezing to death or starving and freezing '...about three million sheep,' Steve Newman, Earth Week. Consider the above evidence as characteristic of the warming impact coming up from the equatorial areas, with the increasing carbon dioxide in the atmosphere, and one cannot deny the entire climate-changing picture."

The Earth Regeneration Society has delineated the imperative for direct efforts toward climate stabilization before it's too late and the critical role of their proposed targets in climate policy.

In order to "halt the accelerating extremes of floods, storms, heat spells, freezing storms, all-time record cold in the winter, and general yet massive rural and urban destruction", Broken Planet—Broken Systems offers a set of charts that provides figures for each country based on the history of their forests and carbon dioxide emissions.

The objective of the energy information and targets is to eliminate most of the CO_2 emissions to the atmosphere as rapidly as possible. The charts include actual emission data and show each country as a percentage of the global total. New technologies for CO_2 reductions are also explored in the text.

Forest information and targets are included as a means to reduce atmospheric carbon dioxide by improving and expanding the world's forests and its additional carbon sinks in the biosphere. The role of swamps, marshes, wetlands, and phytoplankton is included.

Global soil remineralization is shown as a key component of the alternative technologies we must develop to stabilize the world's climate. The author, Alden Bryant, establishes the targets for our world's forests in consideration of (1) forest cutting (with partial replanting), (2) forest burning and forest fires, (3) drought and (4) deteriorated soil mineral conditions (after 10,000+ years of the interglacial period) leading to weakened, dying forests more susceptible to pest infestation, burning and storm damage. Here is an excerpt from the section "Alternative Technology Development for Environmental and Social Stabilization":

"Given the problem (climate change climate stabilization) the solution (soil, forest, energy work), and available science and related technology to carry out the solutions, we therefore look to the following range of applications for the solution.

SOIL: Remineralized Organic Agriculture

- *compost* — further assistance
- *microbial* — basic to growth

} organic

- *stimulant* — further growth, water retention
- *rock dust* — minerals

} inorganic

FORESTS: Forest care includes soil improvement in old areas and new forest plantings with native species, plus some are allocated to fast-growing plantations."

You may place an order for the book from: ERS, 1442A Walnut Street, No. 57, Berkeley, California 94709, USA.

Voice Mail: (510) 849-4155; FAX: (510) 849-0183

The cost of the book is $20.00 U.S. currency, which covers packaging, handling, mailing and sales tax. Checks should be made payable to ERS. RE

Kirk Waterstripe (left) and Jared Milarch (18 years old) monitor tomato plants at the Northwestern Michigan College Greenhouse.

Milarch tests trace element fertilizer in greenhouse trial

BY DAVID YARROW
December 1997

Like so many young people, Jared Milarch was in a hurry. At age 13, Jared began transplanting native sugar maple seedlings out of his family's woodlands in northwest lower Michigan. Thinking ahead, Jared planned to sell them as street trees to pay for his college education.

Watching this investment in his future creep skyward, Jared wondered how to speed these trees up — grow taller faster.

"I got impatient because the trees weren't growing fast enough," Jared admitted

About this time, Jared read *Secrets of the Soil* by Christopher Bird and Peter Tompkins. One chapter described a fertilizer that stimulated plants to remarkable vigor. This "miracle" plant food is a powdered pink clay from central Utah named Azomite, an acronym: A-to -Z-of-Minerals-Including-Trace-Elements.

I asked Jared what Azomite is.

"Ground up seafloor bed from Utah mines," he replied. "They grind it up talcum powder fine. I guess it's easier for plants to digest then."

"And for the microbes, too" added his father. "Because plants don't really take up nutrients in their root hairs, but from dead and living bodies of micro-organisms that ingested the minerals."

Azomite is, in fact, a unique mineral deposit with special biological character. In ancient geological time, central Utah was an inland sea. Water washing off then-young Rocky Mountains was rich in minerals, and, over eons, this body of water evaporated and shrunk, until today only the Great Salt Lake and Great Salt Desert remain.

Bacteria living in this inland sea ate the minerals, then excreted them in oxidized, hydrated and blended forms. The microbial manure accumulated on the seafloor. This sediment has an abundance of over 60 elements, not just three or four, or a dozen.

"I didn't have a lot of money, so I kept bugging my dad to order a few bags," remembered Jared. "He reluctantly gave in. When the bags arrived, I sprinkled two tomato soup cans around each baby tree." After 100 trees, his bags were empty, so his other 400 saplings got none.

The next spring, Jared watched his unfertilized trees grow 12 inches. But the Azomite-treated trees grew fully three feet in one spring spurt! In Jared's years working in his family's shade tree business, this was unprecedented beyond imagination!

"The results were just amazing!" enthused Jared.

But even more, treated trees grew not only taller, but better — healthier. Treated trees had darker color. "Leaf tatter was minimal," explained Jared. "Caliper [diameter] of their

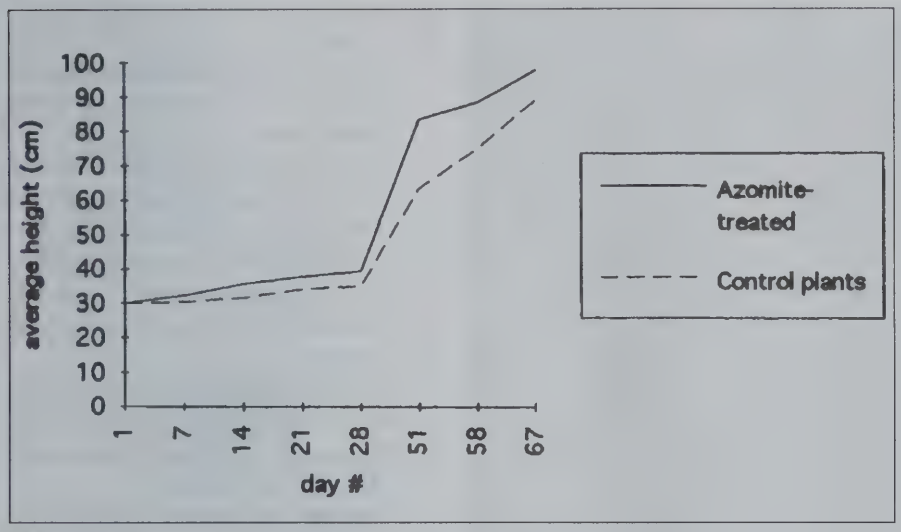


Table 1: Comparison of tomato growth rates.

trunks was up, too."

Impressed by these results, Jared bought more to sprinkle around all his trees. In the family garden, too, where the effect was similar — bigger, stronger plants, with one further benefit. "The taste of the vegetables is dramatically different," reported Jared. "It's a great taste!"

His father David — a third generation nurseryman in this remote corner of northwest Michigan — took notice of Jared's fertilizer results. In 1996, David decided he had seen enough financial gains on his tree farm, and read enough evidence, to become an Azomite distributor.

"After the Gazette article about Jared's discovery, we got more and more calls from all over the country about Azomite. The closest distributor to Michigan was the State of Maine, so I decided to stockpile it here so local people don't pay double freight, and make it available to anyone inclined to try rockdust in their garden, orchard, or animal feed."

Soon the Milarch barn was stacked with bags of pink Utah dust.

"Also, as Midwest horticulture and agriculture schools smarten up, I want to have a stockpile. In the horticulture industry, no one we work with on our trees in all eleven colleges across the U.S. has ever heard of remineralization with rock dust. They add magnesium to commercial fertilizers, but know nothing about trace elements. It's time the tree industry — all the way from seedlings to Champion Trees up to wholesale shade tree industry — tested this in horticulture."

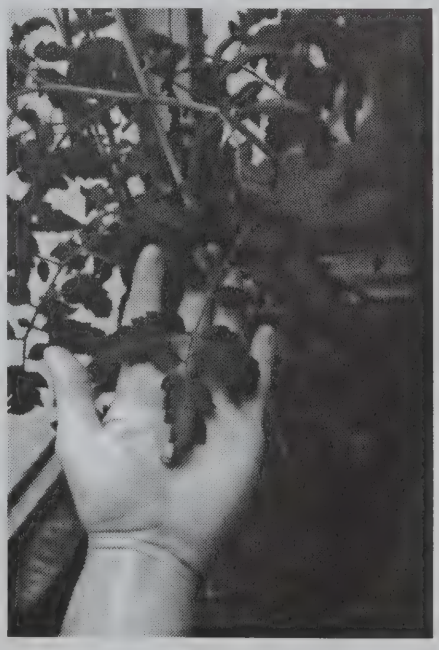
David Milarch, with decades experience in the family shade tree business, founded The Champion Tree Project. The effects of Azomite on his tree farm urged him to require that every Champion Tree must be sold and planted with rockdust.

"In The Champion Tree Project, seedlings distributed to schools, children and youth groups for Arbor Day will have a small bag of rockdust, with instructions to sprinkle it around the roots. I recommend seed companies use it in soil mix as seedlings are produced. And right up the ladder when shade tree liners are grown by nurseries, I ask them to use rockdust. Then, as shade trees are planted at job sites, one or two pound bags must be spread by landscape industry."

In 1997, Jared — a fast-track senior honor student at Benzie Central High School — enrolled in a Botany class in Michigan State University's Horticulture Extension Program at nearby Northwestern Michigan College in Traverse City.

For his Botany lab, Jared decided to scrutinize this Azomite miracle more carefully to understand how a bit of dust boosts plant growth and health. He proposed a controlled experiment in the college greenhouse to professor Kirk Waterstripe.

His professor scoffed at the idea at first.



Jared Milarch lifts the compound leaved of the tomato plant. The plant on the right recieved azomite, and the plant on the left did not.

The four tomato plants on the left received azomite, the four on the right did not.

Waterstripe, a Rutgers graduate, was skeptical a few ounces of powder from the Utah desert could have such dramatic effects on plants. "I've done some organic gardening," Kirk admitted, "but haven't messed with rock powders at all. I heard about greensand and a few things. But I'm always open for new ideas."

Jared insisted this new idea was worthwhile, so Professor Waterstripe relented and assented.

With advice from his professor and father, Jared designed an experiment to test the effect of Azomite as a soil supplement on tomatoes. Jared's very simple, but controlled experiment would clearly show any effects from Azomite.

Eight tomato plants ("Fantastic" variety) of uniform size were grown in one-gallon plastic pots, in a mix of standard potting soil with six tablespoons of composted cow manure. Two tablespoons of Azomite were added to the soil of four tomato plants; the other four had no clay mineral supplement.

The plants grew in uniform greenhouse conditions from June 17 to Sept. 9, got 150 milliliters of water three times a week, and were rotated in the greenhouse to ensure equal exposure to warmth and light. Height was measured from soil surface to uppermost branching point. All measured 30 cm at the experiment beginning, with no visible differences in health.

After 67 days, the tomatoes fed Azomite were easy to distinguish from untreated vines. On several measurable characteristics, Azomite yielded a better plant. Everyone agreed all four plants fed clay dust looked bigger and healthier.

"Color was a very obvious difference," recalled Jared. "Plants not treated were more yellow in color, while treated plants were a deeper green color. Height was different. Plants that were treated weren't a lot taller, but they weren't 'leggy'."

Jared's short written report listed five significant observations he had measured as numerical indications of "better, healthier" plants:

- Average height of Azomite-treated plants was 98.5 cm, compared to 89.75 cm for control plants. (Fig. 1)
- Whiteflies were found on both treated and control plants by day #28. After day #42, insecticidal soap was sprayed to control whiteflies. But treated plants had much less damage (Table 1), defined as "honeydew"–sticky, sugary excretions by whiteflies.
- Azomite-treated plants flowered earlier, more prolifically (Table 2).
- First tomato was on an Azomite-treated plant on Aug. 26 (Table 3).
- Treated plants set more fruit (Table 3).

In a summary as simple as his experiment, Jared wrote: "While four plants per treatment do not provide statistically testable results, this experiment suggests that mineral supplements such as Azomite may help produce plants that are more vigorous and pest-resistant, and that blossom and set fruit sooner than plants grown without any supplement. Further tests, both in lab and field, are highly recommended."

But from this modest understatement issues a bright light of insight. The implications of this simple experiment could alter farm economics, food production and horticulture methods. Only four plants, but a solid, significant 4-versus-4 superiority. This clear, consistent result confirms a long list of field observations. Definitely, this Utah powder provides some nutrient lacking in greenhouse potting soil — and northwest Michigan topsoil. Something so essential that just a trace of it effects significant gains in growth, vigor, sturdiness, color, flavor, flowering, fruiting, and pest resistance.

Tests of this remarkable result should be repeated not just by one observant and thoughtful high school senior, but also by other universities and high schools in many different locations,

"We need to encourages students, teachers and professors to try this simple experiment'" insisted David. "Not just my state, but around the nation — around the world."

Professor Waterstripe — impressed by Jared's results — is singing a new song of

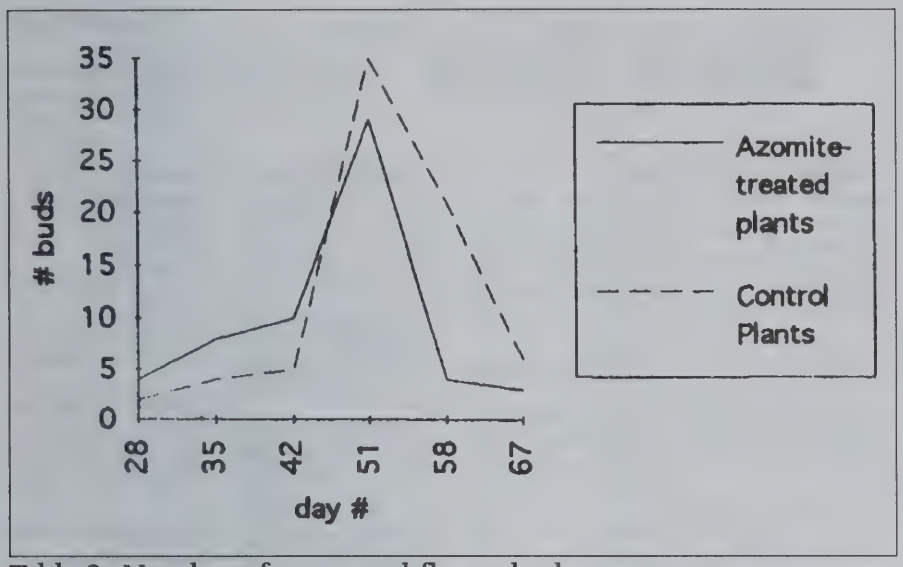


Table 2: Number of unopened flower buds.

praise and wonder. He now sees real potential value in this clay from the Utah desert, plans to write his own paper for a science journal, and wants to test Azomite on other crops. The prof is even considering writing his doctoral thesis on this trace element effect.

Jared, David and Waterstripe all discussed with the financial potential of early flowering for farmers.

"Early flowering plants can mean money to farmers for having the first crop, and ultimately quicker money for the farmers," Jared pointed out. "It's a big fruit farming area around here."

"Among farmers, the first guy to market or processing plant," David explained, "his products reap a premium profit. The first tomatoes. First sweet corn. First watermelons. Also, shorter growing season means faster pay-off, because farmers only have one paycheck a year."

"Flowering is a measure of marketability," agreed Kirk Waterstripe. "If you're the first to the farmers market with vine-ripened tomatoes, hundreds of people will stop by your truck. So, if you can get the plants to flower a week ahead, this gives you an economic advantage."

"But how do you put a dollar sign on depleted soils?" asked David "And toxic, even mutagenic, pesticides?"

I insist the single most crucial and significant effect of trace element fertilizers is increased flowering and seed formation. This can't be adequately measured in monetary quantity or economic values. Reproduction is the climax in a plant's life cycle. Any substance that triggers such an increase in this activity activates and fulfills the plant's full life potential, and is a near ideal and essential plant food.

In an ecosystem, this climax is an outburst of ecstasy as nature rejoices in this peak experience. This isn't mere substance, but essence.

Jared and Professor Waterstripe plan another experiment with winter oats, a common grain crop for Michigan farmers. The oats will be grown indoors in six flats; each flat will be treated differently.

"Oats have been — for millennia — a chief animal and human food," David pointed out. "We eat oatmeal. Horses need oats, and it's mixed with other animal feeds. And oats are used as a cover crop a lot."

"Oats are easy to grow and study in a winter greenhouse," added Kirk. "They don't take a lot of room, and can take a cooler greenhouse. We want to do tissue analysis, but what's holding us up is funding. We'll look at minerals we put in, soil tests before and after, then testing plants to see what they take up. Also a dry matter comparison."

"We'll do topsoil alone as a control, then topsoil with Azomite, with compost, and with Azomite and compost at manufacturer's application rate. Then we'll do another series at half strength, and a third set at double strength. They'll fit in the greenhouse, and we can get viable results with about six replicates of 40 to 50 plants."

I weary of experiments to repeat what we rediscovered a decade ago that was discovered by others over a century ago. How many academics and scientists have to see the facts before serious research begins?

We need experiments to learn, not "if," but "how" mineral powders restore soil fertility and boost plant vitality. Decades of research by dozens of investigators clearly show this happens, but we still have only fragments of real insight into the secret lives of soil that accomplish this miracle of minerals transformed to living cells.

I asked Jared what he thinks causes of Azomite's remarkable effects.

"I believe there's a lack of minerals in the soil," Jared mused. "It was probably depleted with chemical fertilizers. So, this was the first step to put minerals back in the soil. Almost healing the soil enough for the trees to really be able to use what's in the soil."

I pointed out that a few tablespoons of clay dust doesn't supply much nitrogen or potassium. What minerals might this Azomite be feeding trees and seeds?

"I think it may be a balance," he offered cautiously. "Not just one mineral, but all the minerals. Or it might catalyze other parts of the soil. It may be etheric, too. I'm not sure."

Whatever substance or essence Azomite supplies, it boosts overall vitality and quality of tomatoes — for seemingly every plant it is fed to. One Michigan news reporter in 1996 headlined Jared's discovery as "Tree Vitamins" — botanical equivalent to one-a-day health pills.

David Milarch pointed out, "Most soils only have their mineral elements replenished by volcanic action or glaciers. Here in north Michigan that was 10,000 years ago. Our old

soils are worn out, especially with chemical agriculture and acid rain."

The Milarchs' positive results have been followed by an expansion of Azomite use.

"This year, one fellow got three tons for his commercial organic orchard and put 60 pounds on each tree — a generous feeding," said David. "But that's how he makes his living. It will probably take two years for fruit trees to fully respond. But if vegetables taste sweeter and are bigger, why won't it do the same for apples, cherries, peaches..."

"I sold another 1000 pounds to add to computerized feed mix for dairy cattle to see if it affects butterfat and milk production. This one dairy farmer had a bad problem with hairy wart on his 300 cows' feet — which is almost impossible to relieve. We figure if cattle are healthier, it will be easier to relieve, so he calculated adding six tablespoons a day to his cows' feed. The old boy who first discovered this stuff fed it to his chickens, and the chicken industry had great success with it."

I asked Jared what he will do with his new insight into soil fertility.

"For the immediate future,.I want to apply this to our family nursery, and to the Champion Tree Project. More likely in the future I'd like to apply it or make it available for world crops — for all of our food crops."

"And our garden," injected David. "if it's good for tomatoes and trees, it's good for humans, too. So take that thought farther from the garden all the way up the food chain."

"I'd also like to study other rock dusts," added Jared. "Azomite is the first one I've discovered."

David ended, "I'd like to see other colleges and students get involved with this investigation of how to restore our soils. And I hope to see the same in the nursery industry and farmers also."

"In the long run, what would be the reduction in health care costs in humans after we get it into the food chain?" mused David, "and we remineralize our bodies? How many dis-eases — like AIDS and cancer — would be dramatically diminished?" RE

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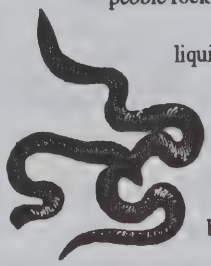

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RESOURCES

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Remineralize the Earth, double issue # 10-11, is available in bulk for conferences and networking to current subscribers only. 10 or more copies at $5.00 each.

Remineralize the Earth, double issue #7-8, is available in larger quantities at a special price to current subscribers for networking:

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SR Research Packets

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SR research around the world for agriculture and orchards. Spiral bound, 146 pages.

SR Forestry and Sewage Treatment

Research Packet 1996 Spiral bound, 82 pages.

See Price List on Subscription page.

Video: USDA Forum on SR and Sustainable Agriculture

A 4-tape set of the Forum on Soil Remineralization and Sustainable Agriculture, May, 1994 at the USDA headquarters in Beltsville, Maryland is available for $65.00

Don Weaver Supplement

Solar or Ice Age? Further Insight and Perspective on Global Climate Change and More Interglacial-to-Glacial Weather Extremes. Spiral bound, 20 page. 1996

$5.00 First Class within the U.S., $6.00 Air Mail Canada and Mexico, $7.00 Air Mail International order sent to Remineralize the Earth.

Hamaker Weaver Publishers

The Survival of Civilization By John Hamaker and Don Weaver ($12.00 ppd.). This important book is the foundation on which SR and the grass roots movement rests.

The Solar or Ice Age? Bulletin (366 pp.) Don Weaver has put together current events supporting climate change from the coming Ice Age perspective, including recent volcanic and tectonic activity, what's happening to forests, and weather as well as global networking of SR news. (1989) Suggested minimum donation $10.00.

New Solar or Ice Age? Bulletin #11 (18 pp.), January 1997. Suggested minimum donation $5.00 to support a wide distribution.

Don Weaver, Hamaker-Weaver Publishers, P.O. Box 1961, Burling ame, CA 94010. Tel (415) 347-9693. *The Survival of Civilization* ($12.00 ppd.) can also be ordered from Anita Hamaker, Hamaker-Weaver Publish-ers, Rte. 1 Box 1490, Seymour, MO 65746. (417) 935-2116.

Video: Stopping The Coming Ice Age

Complete 57-minute version by the late Larry Ephron currently available from Lynne Ephron Sarafian, 406 1/2 Laurel Ave., Menlo Park, CA 94025. Tel. (415) 323-4034. The cost is $33.95, plus $3.50 for shipping and handling within the U.S.

The video is also available from The Video Project, Films and Videos for a Safe and Sustainable World, Catalog 1993, in an edited 45-minute version for $29.95. Call 1-800-4-Planet.

Earth Regeneration Society

An active and effectively organized network, stimulating and coordinating initiatives in scientific research and both governmental and non-govern-mental policy. Alden Bryant, President with Fred Wood Sr., Ph.D. and others. Earth Regeneration Society, 1442A Walnut St. #57, Berkeley, CA 94709. (510) 525-4877 or Fax (510) 559-8410. RE

RECOMMENDED READING

The Survival of Civilization

John Hamaker and Don Weaver's important book is the foundation on which SR and the grass roots movement rests. To order, see listing for Hamaker Weaver Publishers, above.

Bread From Stones

The book by Dr. Julius Hensel and his pioneer writings from the 1890s on stone flour for agriculture, is now available from the Acres U.S.A. mail order bookstore. In addition to the classic text, Acres U.S.A., has included comments by John Hamaker, among others. Softcover, 102 pages. Order No. 4024. Send $11 in U.S. and $12.00 outside U.S. postpaid). Acres USA, P.O. Box 9547, Kansas City, MO 64133.

Secrets of the Soil

This book by Peter Tompkins and Christopher Bird is a sequel to the now classic Secret Life of Plants. There are four chapters on remineralization. A fascinating account of recent breakthroughs scientific and spiritual that can save your garden or farm. This book is available, or can be ordered at your local bookstore. It is published by Harper and Row.

Letters & F

Responding to the Champion Trees Project

Larry Geno: There is a dangerous flaw in reasoning behind this project: that existing remnant *Big Trees* possess some genetic supremacy.

Firstly, these trees remain largely as he states: due to location and luck, not genetic composition, unless he can explain how DNA adapts to chainsaws! They are not big because they are best. They are big because they are old and no one cut them down. In fact, the very reason for them being bypassed at harvest may relate to their genetic inferiority.

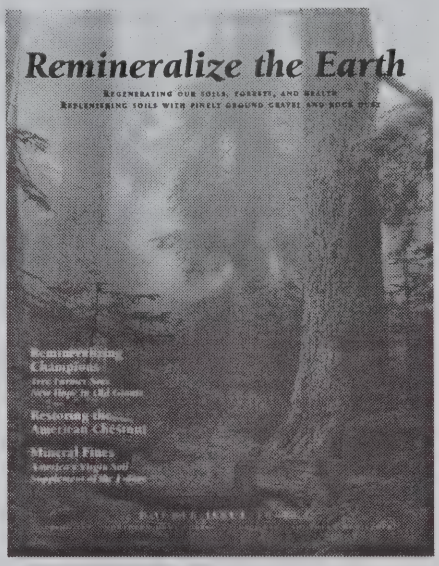
Furthermore, 'best' genetics is site specific, just like his southern sugar maples example. And even on a state-by-state basis, the choice of single 'best' tree will not be broadly adapted across the state. Perhaps the best genetics reside in regrowth rather than old-growth remnants, and a broader selection should be made.

Worst of all, he is adopting the 'plant patent' approach which, while generating funding, is well known in its effect to reduce biodiversity, regionally adapted biotypes, and use specific selections. I'm not impressed.

David Yarrow: *Like many people who first hear of The Champion Tree Project (CTP), Mr. Geno misunderstands this complex initiative. Like many scientists, he judges CTP based on what HE thinks is important: genetics. Sadly, Mr. Geno only criticizes dangerous flaws, when we need creative, cooperative response to global ecological challenges.*

Genetics, however, isn't all CTP is about, nor does it depend on genetics to succeed. CTP is about reversing our horrible history of extractive forestry, and preserving tattered remnants of forests, beginning with the Champion Trees. With or without valuable genes, we need to identify and protect these surviving elder giants.

Mr. Geno is correct: the National Register of


Remineralize the Earth
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Replenishing soils with finely ground gravel and rock dust

Big Trees selects trees — not for genetics — but only the single attribute of size, measured as height, girth and crown spread. But biggest is not best. A National Register tree doesn't necessarily have special, valuable, or best genes.

As Mr. Geno says, some Big Trees survived North America's clear-cutting because they were undesirable to loggers. But many factors allowed these giants to endure. Others thrived in botanical gardens or similar sylvan sanctuaries. Many persist in old-growth forests — tiny remnants of undisturbed, ancient timber. A few are inaccessible, such as on swamp islands.

So Mr. Geno rushes to premature judgement to say the Big Trees have no genetic value. No one yet has systematically, seriously studied them to learn if their genes have value — or not. This is what CTP will do: if we find scientists to cooperate. To make this feasible, CTP will plant Champion clones in Living Libraries at universities and research centers easily accessible.

Nonetheless, many Big Trees are genetic treasures. Sturdiness, good form, hardiness, and resistance are what we hope to find in other Champions. Hopefully such qualities can be passed genetically to new generations of trees. But years of search and research are needed to definitively answer such questions.

Mr. Geno is right that, like politics, the best genetics are local. A State Champion in New York is likely better adapted to local soil and climate than a National Champion from Michigan. And certainly saving more than one specimen of each variety expands the base for biodiversity.

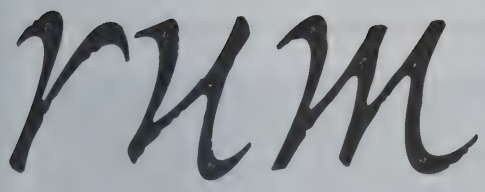
Each year each state CTP chapter will harvest buds and seeds from their Champions — State and National — to preserve and propagate. Further, our long-term goal is to initiate local Champion Tree lists: regional, perhaps by county, or by climate subzones.

Expanding Champion lists to smaller localities expands the genetic base, and heightens success to preserve biodiversity and ecosystem stability. Best of all, local lists involve more people and communities in rituals to identify, honor and preserve their own best trees.

Champion Trees can't be patented, anyway. Only man-made or engineered lifeforms can be patented. The appropriate instrument for CTP is a trademark — a commercial license for a particular product, process or service. Like a patent, a trademark also pays a royalty to the owner of the mark — and the original plant materials. Trademarks are routinely used in nursery industry. We will try to use this instrument wisely to benefit Nature, not merely ourselves or our Project.

Larry Geno: As past Wash. Director of The American Chestnut Foundation and someone who ran two international conferences on chestnut culture, and distributor of 10's of thousands of American chestnut seedlings from my Bear Creek Nursery in the 80s, I'm astounded to see this misinformation. They obviously don't know about the Foundation, it's research program, or its impending release of blight-free American chestnut.

Secondly, there is no hope of finding a new genetic strain that is resistant under their pro-



gram. (see ACF)

Thirdly, distribution of sprout seeds into areas not presently infected with blight could spread the blight, particularly into alternate hosts like oak or here, eucalyptus, even tho the chestnut has juvenile resistance to the fungus the seed carries. Risky!

Additional mistakes: chestnut bark disease fungus does not *girdle the tree,* or *consume the inner bark,* or *eat around the trunk.* It proliferates in the xylem and phloem capillary tubes, causing a congestion much like hardening of the arteries in humans.

Will you people please get together and clarify these issues?! There is opportunity for ACRE to work on from ACF work, but there is no benefit in the current ACRE program.

Again, I'm only trying to help make sure good information gets out to the people.

David Yarrow: *When I wrote the ACRE essay, I was on my broken back recovering from catastrophic injuries, including shattered spine. I couldn't even walk to a shelf to get a book, or access any other resources, and thus had to rely strictly on my 15-year-old memories.*

At the time, I was vaguely aware of ACF and other efforts to preserve our most endangered American tree. Since I wrote ACRE, I have learned more, and am impressed with the extent, detail and scale of these efforts. One third of ACRE — the most tedious, complex third — is well underway far better than I could ever hope to organize and sustain.

While my choice of words to describe the blight was less than precise and clear, the intent of my image is accurate. Chestnut blight doesn't eat away outer bark, but through inner bark's tubes that carry sap. Once fungus obstructs all the tubes of the trunk, sap flow between roots and crown is shut off, so the top withers and dies, leaving roots struggling for light in the soil.

The effect is more like Candida — a living fungus — than arterosclerosis — a sludge-like debris — in humans. Few folk die from Candida directly, but it weakens immune systems to leave its host vulnerable to other infections and delusions.

For Mr. Geno to say no hope is to extreme and harsh. Little or small might be not only more accurate, but generous and kindly. In the complexities of Earth repair and ecosystem regeneration, chance, luck, serendipity, and synchronicity are operative parameters of the this creation, not randomness or chaos.

Thanks for the warning about spreading blight by seed. Past work with organic farms and certification made me aware seeds and soil can spread infections, but i'm not advised of such dangers with chestnut blight.

Lastly, the CTP isn't merely one man's flash of fantasy or clever concept. Rather, David Milarch is deeply disturbed by the plight of trees, decline of forests and threat to future generations — especially his own sons. So this lover of trees prayed for something he could do offer hope for our future. And CTP was the answer to the prayer in his heart.

Similarly, ACRE was my own inspiration given in a time of personal crisis. Let me merely say that in my own dire need, I experienced a deep empathy for the chestnut's plight.

For the trees, Larry Geno, Lismore, nsw 2480 Australia

American Chestnut Foundation, P.O. Box 4044, Bennington, vt 05201-4044; 802-447-0110, John Herrington, Exec. Director

The best fertilizer

I wanted to tell you about what I read on the "best fertilizer man has ever seen". Have you heard of Willard water, or LA water? There is a book called *Aqua Vitae* that states that the lignite coal in the black hills of South Dakota can be "catalyzed" by Willard Water into a fertilizer that is non-toxic and works miracles. They are setting up a plant to produce it but are in need of money. They say the lignite coal has the most dense nutrients locked up in it but it is unusable because of toxic substances like benzene, etc. But Willard Water renders the benzene harmless. They put it on their lawn that was unable to grow grass and now they cant cut the grass fast enough.

Steve Molad
6100 Ohio, Apt. 1128, Plano, TX 75024

Studying mineral dissolution rates

I have landed at the University of Western Australia where professor Bob Gilkes is very glad that I am doing the work that I'm doing. I also have met with Barrie Oldfield this morning and he too seems very pleased to have me on board.

Although it is early days yet, it appears that my focus will be on the dissolution rates for the primary minerals in granite (the only realistic source of rock dust in WA) when applied to the soil as a rock dust form.

I am sensing that the work will have two components: 1. A geochemical approach to the rate of dissolution of the primary minerals and hence the availability of the nutrients to plants. 2. A pedogenesis approach to the rate of soil formation.

It is still early days, and it will probably take a few months before I get a clear picture of the work that I will be doing. My first step though is an exhaustive review of the literature, and I would like any help that I could get from your work, especially in regards to the geochemical processes. I already have a copy of the remineralization packets for both agriculture and forestry. I understand that the USDA is also doing some research, and would like any contacts that may be useful for me at both the USDA or any other research institute that is doing remineralize research.

I'm looking forward to hearing from you and beginning the journey in earnest!

—Andrew Harley
Crawley, WA
Australia

Glowing blue bions

At our new place, I've been applying rock dust to our garden (exceptionally good results) as well as to a few trees which are dying, presumably from root fungus. Microscopic observations of rock dusts show a rich field of vigorously-moving and glowing blue bions, quite impressive. So there is a direct empirical link between remineralization and the life-energy theory of Reich. This may explain why rock dusts work so well, even though biochemical theory suggests that mainly silica rock dust should have no effect. Our new laboratory, now being set up in the

forested areas near Ashland will allow some direct focus upon this problem. An enclosed flyer gives more details.

— James DeMeo
Burlingame, California

Restoring health to the earth

alive is a Canadian Journal of Health and Nutrition. We publish nationally 12 months a year and cover all aspects of whole food nutrition, which, of course, begins with healthy, mineralized and microbe-rich soil.

I would like to be on your list to receive your publication. I would also like permission to excerpt from Remineralize for our Green Magazine section in *alive*.

Since restoring health to the earth is the foundation of human health, *alive*'s continuing message is to make people aware that they must demand food that is organically grown on soil rich in minerals and trace elements.

— Rhody Lake
Editor, alive *magazine*
Barnaby, BC
Canada

Revegetating with sea grass

I was browsing through the Permaculture International Journal and I came across your organization promoting remineralization. I have a video on the subject and I feel it is an excellent way to bring back land that has been abused.

In Australia we have a composted sea grass which is high in all the essential trace nutrients (elements) and humus which is also an excellent way of re-establishing vegetation on very bare areas including pure sand.

Its colloidal makeup and similar qualities of Peat Moss make it an excellent material in revegetating areas that are on the decline.

It has revitalized all varieties of fruit trees and vines in Australia where other fertilizers have not worked. It is the only composted sea-based product on the Australian market and has been exported to South Arabia and to Japan as a fertilizer and a soil conditioner.

— Tony Vlatko
Tamworth, N.S.W.
Australia

Double Issue 12–13

Once again, the immense amount of research and writing on Soil Remineralization has prompted this Spring's long double-issue. We thank you, readers, for your sustained patience in awaiting its release. While we couldn't be more pleased with the range of topics the magazine addresses and the overall quality of each article, we know a double-issue effects the state of your subscription. Usually, an individual subscribes for one year, or three issues. If you have most recently subscribed or renewed in order to receive our last double-issue 10-11, it is time again for you to renew. Economically, it's absolutely essential that we are paid for the other "half" of this double-issue. We hope you find that the great energy that made this issue so fruitful has been worthwhile in aim and effort.

—Emily Hatfield, Managing Editor

Promoting sustainable agriculture

We are an NGO promoting sustainable agriculture and sustainable natural resource management in Kenya. For the last two years we have been conducting research on the efficacy, socio-economics, agronomy, etc., of using rock phosphate (from Tanzania) in partnership with local farmers. We have demonstrated positive effects in a relatively short period. The supply of rock phosphate (RP) has however not been reliable. The farmers now want to start their own stores in the villages to sell RP. We also need to expand the program to benefit more people.

We are looking for organizations we can collaborate with in this project and other similar activities. We also need financial assistance. If anybody out there is interested, please contact Dr. Eusebius J. Mukhwana, Project Leader, *Sustainable Agriculture Centre for Research and Development in Africa*, P.O. Box 2275, Bongoma, Kenya, Africa.

— Dr. Eusebius J. Mukhwana
Bungoma, Kenya

Developing permaculture institute

I am exploring the feasibility of developing a permaculture institute in the semi-arid plateau region of western New Mexico. In this area we have a majority population of indigenous people who have lived productively in the region for hundreds of years. Agriculture practices have included dry farming, grazing of sheep, goats and some cattle, and limited crop irrigation. Developments over the past 100+ years have pushed the region toward dependence on outside producers for food and goods, not to mention general economic welfare.

As part of any development plan for the region we must consider ways to restore our ability to produce food and to maintain a healthy relationship with the land. Because of the fundamental importance of the land, your focus on soil remineralization is of interest to me. I would appreciate receiving information on the topic including research leads and a copy of your publication.

— John Guffey
Gallup, New Mexico

Geologists and remineralization

I've just recently discovered this idea of soil remineralization, and the possibilities are very exciting; it combines my interest in the earth with a desire to make a contribution, and my own efforts to improve my health.

I'm a geologist, and I'm curious if and how geologists have worked on soil remineralization. I'm interested in the geologic aspects of this, but also in all aspects of this problem — what elements humans need in our diet; how we get those plants; what the

Recognize market for mineral fines

International action to stabilize greenhouse gases will lead to carbon dioxide, methane and nitrous oxides reduction goals at the climate change conference in Kyoto, Japan, in less than six weeks. These goals, regardless of their magnitude, will add new value to mineral fines, if we act wisely and expeditiously.

In addition, there is mounting public support to better protect the environment of the nation and this planet. Pollution of air, water, soil and our food supplies are generating this concern. Still, it is not necessary to embrace these environmental concerns in order to recognize the huge potential market for mineral fines.

Mineral fines, if effectively incorporated into agricultural practices, will:

- Reduce the need for petroleum-based fertilizers and pesticides, thereby limiting the environmental consequences of their application, including nitrous oxide emissions;
- Stimulate microbial activity in the soil, thereby increasing yields, improving plant resistance to disease and insects, and enhancing the nutritional value of the crops;
- Catalyze the synergy between the soil microbes, plants, water and air, thereby increasing the adsorption of carbon dioxide by plants and microbes. This will increase levels of organic matter in the soil. The soil thus becomes and improved carbon sink;
- Increase the soil's ability to biodegrade and detoxify harmful materials deposited as a result of agricultural, commercial and industrial operations;
- Increase the effectiveness of composting operations, thereby reducing methane emissions; and
- Improve farm and forestry economics.

The simple application of Rock Dust alone will not reap these benefits. Scientific analysis, the development of formulations incorporating mineral fines along with other natural and biologically-based materials, and their proper application will produce the sought after results.

The simple application of Rock Dust alone will not reap these benefits. Scientific analysis, the development of formulations incorporating mineral fines along with other natural and biologically-based materials, and their proper application will produce the sought after results.

Most forms of Rock Dust will have to be formulated in order to produce cost-effective benefits. There is no reason why that formulation cannot occur on site or near quarry operations, thereby minimizing the hauling costs of the heavy materials. There are no reasons why ancillary test cannot be performed at several sites, on different crops, grown in different soil conditions, with varying formulations and using locally available mineral fines. Careful coordination of these tests is key as well as controlled conditions, responsible researchers (good farmers and foresters) and standard reporting formats.

This need not be a highly complex process, but it must be thought through scientifically and pragmatic experiences effectively applied. It is also not critical to optimize success before moving into the marketplace. Cost effectiveness is the only opening criteria. Improvements and optimization will follow.

The USDA Research Center of Beltsville, Maryland, is the logical starting place. The ground-work already accomplished by Lee Fryer, along with his experience and assistance from his colleagues, has initiated needed action. There is no question that governmental support is available and should be forthcoming. Concept design and effective liaison with government officials and work with the political dimension of government and the congress is critical to the receipt of this support.

Dr. Lumsdren's project at Beltsville could be seen as the hub of a wheel, the spokes extending out to field projects. The focus of these field projects can–and should–be sharpened by existing information. The internet may serve the crucial purpose of connecting interested and knowledgeable farmers, foresters and remineralization advocates around the world.

In summary, mineral fines are available. Concern over the build-up of greenhouse gases have opened the door. We should aggressively explore that opening.

— William C. Holmberg, President
Sustainable New-Wealth
Industries Inc., International

plants need in the soil; how to get those elements back into the soil; the results that have been achieved; and what research has been done. I'd like to find as much information as possible, so if you have other sources of information that aren't in the research packet, I'd appreciate hearing about them. I'm particularly interested in companies or organizations that are actually distributing rock flour, and how they do it; if you have a list of these, please send one along.

— David Smith
San Diego, California

PAST ISSUES INDEX

Remineralize the Earth Magazine

RE Double Issue # 10-11
Spring 1997, 88 pp. $10.00

Articles: Forest of Champions—Tree Farmer Sees New Hope in Old Giants, David Yarrow; Rock Dust for Australia's and the World's Mineral-Poor Soil, Barrie Oldfield; The Effects of Minerals and Trace Elements on Soybean Growth and Rhizobial Activity, Mark N. Mead, et. al.; The Nutrition-Mind Connection, Dr. I. Gerald Olarsch, M.D. and Susan Stockton, MA, CRC.

RE Issue # 9
Summer 1996, 56 pp. $5.00

Articles: The Klinki Forestry Project for Costa Rica, Dr. Herster Barres; Can Remineralization Save the Tropical Rain Forest?, Sarah Bruck; Selecting Sites for Remineralization, Deborah A. Kramer, U.S. Bureau of Mines; A Long Term Reclamation Study: Hopkins County, Kentucky, Dr. Terry J Logan, et. al.

RE Double Issue # 7-8
Summer 1995, 80 pp. $8.00

Articles: Soil Remineralization: An Essential Environmental Action, Fredrick I. Scott, Jr.; The USDA Forum and Beyond—Where Do We Go From Here?, Andrew Euston, AIA and others; An Overview of the Regional Nature of Mineral Fines, Dr. Aldo Barsotti, U.S. Bureau of Mines; Earth Regeneration Center in Scotland, Cameron and Moira Thomson.

RE Issue # 6
Winter 1993-94, 55 pp. $5.00

Articles: Industry Leaders Address Remineralization, Joanna Fritz; Rock Dust and Microbial Action in Soil, George Leidig; SR with Sea Water, Dan Hemenway; Weather, Climate, and Planetary Health, Don Weaver; River's Turn Farm: An Interview with Organic Grower John Sundquist, Carol Cina.

RE Double Issue # 4–5
Spring 1993, 71 pp. $5.00

Articles: Making Communities More Sustainable, Joanna Campe; Fire and Ice, Greg Watson; NAA Task Force on Remineralization, Joanna Campe; Rock Dust and Humans, Barrie Oldfield; Top Produce Attracts Star Chefs, Sibella Kraus.

RE Issue # 3
Spring 1992, 53 pp. $5.00

Articles: Regenerating Appalachian Forests, Dr. Robert Bruck; Rock Dusts for Human Nutrition, Harvey Lisle; How to make Topsoil, David Yarrow; The Men of the Trees, Barrie Oldfield; Planters II: The High-Test of Rock Dusts, an interview with Dr. Herb Owen.

RE Issue # 2
Summer-Fall 1991, 45 pp. $5.00

Articles: Reconnecting Children and Ourselves with the Earth, A Call for Action, Fred B. Wood, IV and Fred B. Wood, III; Rock Dust May Give Trees Dying from Acid Rain a Second Chance, Ed Brackett; Keyline Cultivation, Dan Hemenway.

RE Issue # 1
Winter 1991, 55 pp. $5.00

Articles: A Call for Action on Soil Remineralization, Fred B. Wood, IV and Fred B. Wood, III; A Technique called N-VIRO: Soil Remineralization, Tad Montgomery; Stone Age Agriculture, David Yarrow; Stabilizing the Climate: What Will it Take?, Larry Ephron.

Soil Remineralization, A Network Newsletter

SR Issue # 17
Spring 1990, 35 pp. $4.00

Articles: Barry Slogrove from Australia, Remineralizing Maple, Christopher Scarfe; Trade Association for Rock Dust Producers, Bertram Cohen; 'Crop Dusting' in California, Yvonne Rado.

SR Issue # 15-16
Fall-Winter 1989, 27pp. $4.00

Articles: NEPA and the Next America: Designing our Transition to Global Sustainability, Andrew Euston; Remineralization Begins at Home, Dan Hemenway; The Snowballing Plea to Save the World Environment, Betsan Coats.

SR Issue # 14
Summer 1989, 23 pp. $4.00

Articles: Warming? No! Just Glaciation and Starvation, John Hamaker; On the Edge of Starvation, Larry Ephron; Unveiling the Coming Ice Age, Mark Nathaniel Mead.

SR Issue # 13 *Out of print.*

SR Issue # 11-12
Fall-Winter 1988, 31 pp. $4.00

Articles: The Climate in 2050, Leon Mercadet; Soil Remineralization, Clodbuster and Drought Damage Reduction, Leland B. Taylor;

SR Issue # 10
Summer 1988, 23 pp. Loan only.

Articles: 35 Years of Experience and Research with Remineralization, Fritz Leipold.

SR Issue # 9
Spring 1988, 27 pp. $4.00

Articles: The I.U.C.N. Conference in Costa Rica, Betsan Coats; A Global Remineralization Program with a Bioregional Program, Gregory Watson; Magic of the Vinegar Jug with Trace Minerals, Arthur and Catherine Summers.

SR Issue # 8
Winter 1988, 27 pp. Loan only.

Articles: The Gaia Initiative for Soil Remineralization, Joanna Campe.

SR Issue # 7
Fall 1987, 23 pp. Loan only.

Articles: John Hamaker Responds to Often Asked Questions; A Dramatic Recovery in Brixlegg Forest, Georg Abermann.

SR Issue # 6
Summer 1987, 23 pp. $ 4.00

Articles: Testing Soil Remineralization, Steven Welp; Should We Interface with the Next Ice Age?, Debra Vuckovich; One Million Trees in a Rucksack, Jeannie Stevens.

SR Issue # 1-5 *Out of print.*

Book Review

The Potentials of Urban Agriculture

Agriculture: Food, Jobs and Sustainable Cities
United Nations Development Programme
Publication Series for Habitat II,
vol. 1,
One UN Plaza,
New York, NY 10017, 1996
302 p., $24.

REVIEWED BY
WILLIAM HURRLE

URBAN AGRICULTURE is a straight-forward book, an overview of the globally-significant phenomenon overwhelmingly ignored by power structures — city people feeding themselves. This book describes current programs, including the benefits, problems and constraints of urban agriculture. It also points to the future of urbaculture, providing a sustainability strategy beyond community supported agricultures' yuppie chow and farmers' markets, though both are crucial components.

Sprawl, migration and food security, press planners to recognize urban agriculture's (UA) potentials. In North America, UA means residential backyard gardens, owned by twenty to thirty percent of households, as well as co-op plots. In the rest of the world it means much more. UA means food for underpriveleged people — often refugees, women and immigrants — and profits for middle class market gardeners, who produce flowers and ornamentals as well as food. Livestock plays a large role, especially fowl, rabbits and guinea pigs, but often pigs, cattle and aquaculture. Urban forests and tree crops — the core of permaculture — grow only where officialdom cooperates. UA is partly a response to the multinationals' green revolution, which displaced villagers to cities where they keep on farming.

Gardening is done, as always, on the edge of cities, but erupts anyplace there is an opening, such as flood planes, roadsides, rooftops, wetlands and community spaces or garden parks. Plots are typically small and labor-intensely cultivated, employing about twenty people per acre. The Netherlands and Japan are advanced in using every possible, often vertical, space. Cities in the United States have much open space eligible for green development. In many of the world's cities, sixty percent (or more) of urban land is dedicated to gardening, supplying a quarter to all of the vegetables, meat, mushrooms and fish consumed in the metro areas, and involving a majority of the households in their production. Informal, micro-entrepreneurial agriculture is changing city land use patterns. Urban Agriculture not only empowers people who might not easily findwork, it reduces transportation costs, provides fresher food and better nutrition, manages wastes, uses less packaging, mitigates disasters, and softens visually harsh urban landscapes. UA is a growing economic sector which works through civil society more than the public sector. Because UA is positive, human-intensive and cultural, it is a kind of political horticulture.

Jack Smit, a member of the *Urban Agriculture* author team, is president of The Urban Agriculture Network, 1711 Lamont St., NW, Washington, DC 20010, 1-202-483-8130, email: 72144.344@compuserve.com. TUAN sells the book, which is also a mine of addresses and bibliographic references, as well as good illustrations.

Other resources available:

- Community Food Security Coalition, which has a booklet, "Community Food Security: A Guide to Concept, Design, and Implementation." Andy Fisher, coordinator: POB 209, Venice, CA 90294, tel: 310-822-5410, Asfisher@aol.com.
(Check out the Canadian UA effort. Ryerson College, Toronto, has a Center for Studies in Food Security.
- In Wisconsin, Mike Salinas of the Hunger Task Force of Milwaukee has a street food program started, 811E. Vienna Ave., 53205, 414-962-3111, hungertaskforce@uttracom.com.
- The Federal Agricultural Improvement and Reform Act of 1996 funds a community food project at $2.5 million a year through 2002. Contact: Dr. Elizabeth Tuckermanty, 2002-720-5997, etuckermanty@reeusda.gov.
- A food security workshop was held at the Michael Fields Agricultural Institute in East Troy (near Lake Geneva) in March, 1997. Dr. Tuckermanty anticipates 200 proposals would be vying for this year's funds.
- The Hartford, CT, Food System, founded in 1978, is a seminal US model. Mark Winne is its director, 509 Wethersfield Ave., 06114, 203-296-9325. It started as a coalition of anti-hunger groups, but has evolved in ways that spark the imagination. RE

IN MEMORIAM

Betsan Coats

BY BARRIE OLDFIELD

We received news that Betsan Coats died at her home in Queensland, Australia, in September 1997.

Betsan had long been an outspoken advocate of remineralization. In the mid-1980s, she visited Perth, Western Australia, to urge Men of The Trees and any other groups interested to begin using quarry rock dust in their work in an effort to catalyze the enormous task of restoring the biosphere through remineralization. After the publication of John Hamaker's book Survival of Civilization, she put all of her energy into promoting the book and particularly its message of both alarm and hope. She traveled widely visiting all of Australia, some parts of South America, Europe, India and the United States, spreading this message.

Her Snowballing Plea to Save the World Environment sublimated the collected wisdom of E.F. Schumacher, Richard St. Barbe Baker, John Hamaker, Gernot Graefe, the Dalai Lama and others, and was widely distributed on audio cassette.

Perhaps her greatest endorsement came from her son, Callum Coats, who surrendered his career in architecture to study and translate the work of Viktor Schauberger. Living Energies was published in 1996 and in it is glimpsed the fascinating world of bioenergy in which rock dust plays so important a role.

Betsan Coats was the first President of the Queensland branch of Men of The Trees, again underlining the closeness of remineralization and massive replanting of trees for the cause of planetary repair.

For Betsan, tree planting and the promotion of remineralization were the essential practical responses to her deeply grounded belief in Theosophy which she and her late husband espoused.

Betsan's flame has fired many followers and their growing number will carry the work forward in this largely unacknowledged science of Earth care. RE

Remineralize the Earth

TOWARDS A SUSTAINABLE AGRICULTURE,

FORESTRY AND CLIMATE

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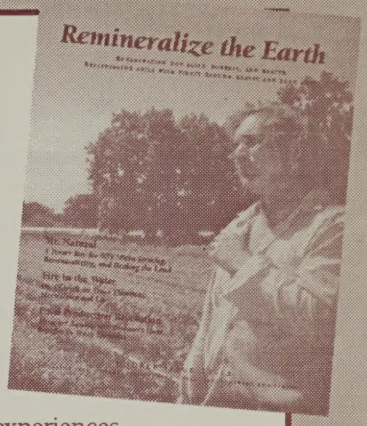

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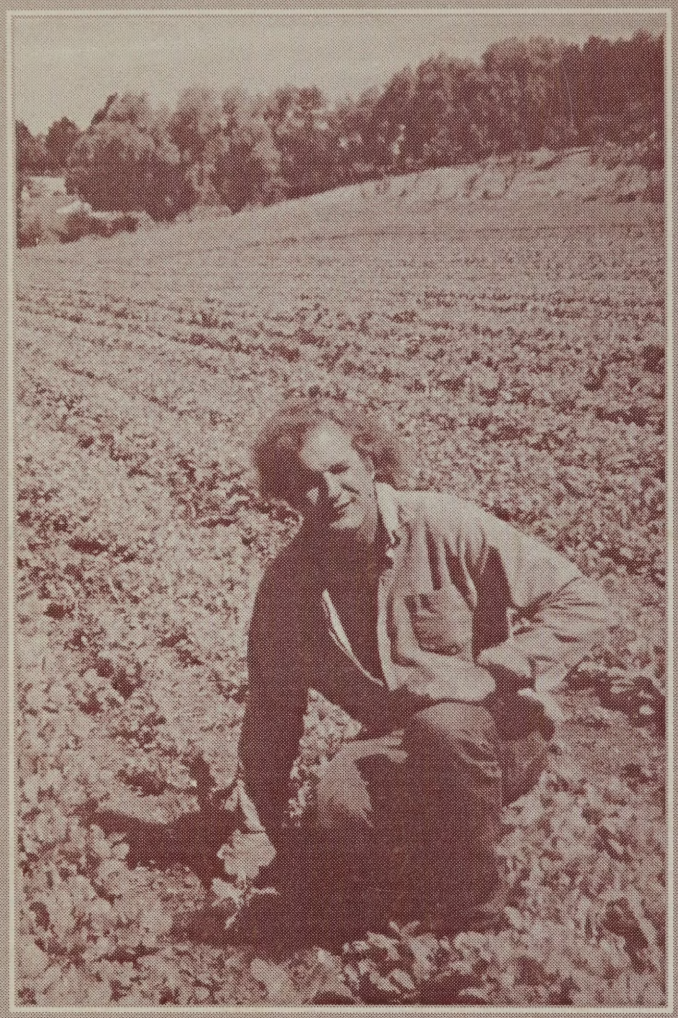

You can see the plant's past by looking at the leaves, seeing the struggles and tribulations, the lean years, the years of flood, in the oldest leaves, or in the growth patterns, the signs of stress within the bark of the tree. We can get an understanding of what it was, all the way to where it is now. You can create a stress-free environment and you get strong plants. You want to grow food that will connect us in that way with nature."

—Bob Cannard, p. 34

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